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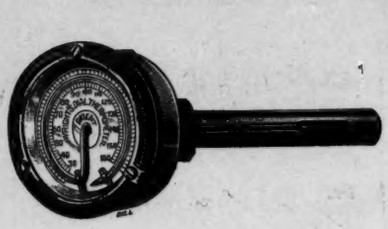

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VOL. CXXXIII., No. 2759.] TUESDAY, MARCH 28, 1916. [68TH YEAR.

EDITORIAL NOTES.

The Institution and Coal Price Interpretations.

OVER the basis price of coal to which the standard of 4s. per ton is to be added, as provided by the Price of Coal (Limitation) Act, confusion is only becoming worse confounded. The interpretations of the Board of Trade as to what is permissible in determining the basis price only institutes a greater indefiniteness than existed previously; and this particularly applies to the expression of opinion on the point in question that Sir T. Ratcliffe-Ellis, on behalf of the Gas Coal Federation, recently obtained from the Board, and which was quoted in our issue for March 7 last [pp. 517, 521]. The inquiry, it will be remembered, that was put to the Board was to the effect as to whether, in ascertaining the corresponding price for the prescribed year ending June 30, 1914—that is to say, for a sale actually effected in that year, and not the deliveries made during the year—it is necessary that the contract of the same buyer should be taken, or whether, if there was a contract with another buyer nearer to the corresponding date of the new sale (providing the coal was of the same description, sold in similar quantities, and under similar conditions), that contract could be taken in fixing the price. The reply of the Board of Trade was that, "so long as the conditions pre-"scribed by section 1 (1) of the Act are complied with, "there is nothing in the Act which requires that reference "should in all cases be made to a sale to the same buyer." We should have thought that the "same buyer" in a transaction (other corresponding conditions obtaining) was not a negligible circumstance. However, the coalowners have not lost any time in putting into operation the extended latitude which Sir Ratcliffe-Ellis ascertained had, in view of the wording of section 1 of the Act, the endorsement of the Board of Trade; and they are placing their own free and easy interpretation upon that of the Board of Trade.

The President of the Institution of Gas Engineers (Mr. John Young) has promptly communicated with Mr. C. F. Marwood, of the Board of Trade, calling attention to the fact that coalowners are interpreting the correspondence to simply mean that they have the right to take as the basis price, in all cases, the highest rate obtained from any purchaser for similar quantities. It is obvious that, if the Act was intended to be of real value by establishing fixed principles upon which to proceed, there was originally no intention that such looseness should prevail. Either adventitious or temporary circumstances may have caused some buyer near the corresponding date of the prescribed year to pay a high price for a similar quantity of coal of the same description; and to expect another buyer to have this exceptional price taken as a basis would virtually mean that the 4s. standard would be raised, and that he would, in all probability, be paying in excess of what other buyers who were fortunate in not making a new purchase near that date were called upon to pay. Acts of Parliament are not especially designed to inflict injustices, when, under such circumstances as are here referred to, they can be possibly avoided. "It "is felt," says Mr. Young in his letter to Mr. Marwood, "that the only way"—we would say, the only fair way—"of giving real effect to the Act, and limiting the "increased price of 4s. over the average, is that the price "paid by an individual purchaser shall be compared for "the purposes of the Act with the previous prices paid "by the same purchaser, provided a purchase has been "made. Otherwise, by taking as the basis price the "highest price obtained, the buyer would be heavily "penalized." The reply from the Board is very indefinite; and it only accentuates the flexibility of the provision as to the basis price. The letter appears to try to console the buyer over the uncertainty in which he now finds himself. "Don't worry; it is more likely than not that the buyer's "own purchase in the prescribed year is the one that will, "through similar conditions, govern the new sale, than the "sale to another buyer." That is the effect of the reply; and it is very unsatisfactory. We can see dispute upon dispute arising; and the Board, we are much afraid, will find that they will be kept very busy through their good-natured willingness "to offer an opinion on any case that may be "referred to them by the parties."

The Board also express the pious hope that buyers and sellers will be ready to interpret the Act reasonably, and not require reference to contracts under which the price is either unusually high or unusually low, owing to special temporary circumstances which may have existed at the time. We wonder what the Board think was the object of Sir T. Ratcliffe-Ellis in communicating with them on the subject. And if the Board are under the impression that charitableness resides among the coalowners as a prominent virtue in connection with coal sales, we would ask them to re-read the "Report of the Committee appointed by the "Board of Trade to inquire into the Causes of the Present "Rise in the Retail Price of Coal Sold for Domestic Use." When there is talk of reasonableness in connection with the fixing of coal prices, there is some doubt as to whether, in the multitude of matters the Board have had to deal with of late, the contents of this report have not escaped their memory.

Promoting the Technical Efficiency of District Associations.

THERE was no occasion for Mr. C. H. Webb, of Stourbridge, to apologize to the members of the Midland Association for the character of his Presidential Address, owing to the pressure there has of late been upon his time. We have both listened to and read the address with great interest. Some Presidential Addresses are composed of so much that is commonplace, and merely a reiteration of statements that have been "done to death," that it is always something for which to be thankful when an address comes constituted of jottings of original thought, and embodying experiences with the materializations of the writer's own views as to details of technical working and commercial methods. Mr. Webb's address is so constituted, and thus the freshness and the interest that are found in it.

Right at the opening of the address, we are confronted with a question of District Association policy. We have never heard there is any general feeling that the number of meetings normally held by the District Associations is insufficient for realizing the best efficiency from them. But Mr. Webb appears to think the number is short of requirement. The question is worth discussing from all points of view; and the President, we are sure, could welcome the *pros* and *cons*, through our columns, of colleagues who are interested in the question of enhancing the usefulness of the Associations to the profession. He takes the Midland Association as typical; and he does not see that two meetings a year for the consideration of technical and other subjects are sufficient to give full effect to the object for which the organization was formed—that is to say, to promote the advancement of the gas industry in all or any of its branches. In the case of the Midland Association, there is a third, or May, meeting, usually devoted to a visit to some works "when no technical business is transacted." "This means," says the President, "that on only two occa-"sions per annum do we discuss matters relating to the "industry." We would entirely dissent from that. If Mr. Webb had inserted "formally" before the word "discuss," he would have disarmed one from making the point that visits to works are technically to professional gas men most educative; and the opportunities so given for chatting over what is seen with colleagues—some of whom rarely open their mouths at meetings where there is formal discussion—are most informative. The visits are not only valuable

through the conversational discussion, but, as a rule, the varied conditions of works are rich in object-lessons, which may at some time or other be turned to good account. We are not disposed to eliminate visits to works from the technical value of District Association proceedings.

It is agreed that the components of the work falling to the lot of the professional gas man are many and varied, and that the subjects to be investigated and discussed are more than can be undertaken at only two meetings—if two meetings of gas engineers were the sum-total of those held in a year, if there were only one Association, and were there no means available of disseminating reports of discussions on the great diversity of topics, and of contributing (through print) the personal information which is possessed by those who do not take part in the discussions. However, Mr. Webb's considered view is that the Association should hold more meetings; and that there should be a new way of dealing with subject-matter. In other words, on the latter point, he believes that short communications or collections of notes would be much more effective than the lengthy papers usually provided in producing interesting and useful discussions. The one thing bears upon the other; the question of contributions bears upon that of the number of meetings. We are believers ourselves in the efficacy of short communications and collections of notes as promoters of discussions; but on what ground, other than increasing the number of topics dealt with, does Mr. Webb advocate them? Here is his answer: "The preparation of a long "paper is a matter involving great expenditure of time "and labour . . . and the onerous nature of our duties "prevents us from giving up the time required in prepara- "tion." Then, again, at the end of the address, he remarks: "I have had very little spare time during the past few "months to devote to the preparation of this address." Admittedly, the duties of gas engineers and managers have been of an exigent character during the past few months; but from what the President says in regard to the question of papers, their preparation is largely a question of want of time—"the onerous nature of our duties" (let us repeat his words) "prevents us from giving up the time required for "preparation." If time cannot be spared for the preparation of papers, can time be spared for attending more meetings? Answer depends on individual circumstances. But, speaking generally, meetings normally claim a large share (variously, of course) of the attention of members of the gas profession. There is the annual meeting of the Institution of Gas Engineers; there are the District Association meetings (some gas engineers are members of two and three such Associations), there are the meetings of Commercial Sections, there are the meetings of the British Commercial Gas Association, and the annual meetings of the Gas Companies' Protection Association and the Sulphate of Ammonia Association. There are in addition for several engineers Council meetings and Committee meetings. The claims on time by these various organizations are necessary, but they are also already great; and therefore it becomes a question whether gas engineers could really afford to have numerically enlarged their engagements for technical and commercial meetings. We think not, and that the present engagements would suffer by the greater diffusion.

Before there is contemplation of an increase in the number of Association meetings, would it not be better to consider the question whether the efficiency of those already held could not be improved? In our opinion, there is no lack of platforms at the present time for all necessary discussion if the best use be made of the time, and if members of the organizations would themselves do each his part in promoting maximum usefulness. The members of the Midland Association will not perhaps mind a little plain speaking. At some of their meetings in recent years, there has been observed a perceptible falling-off in the attendance of members. What has been the cause of this? Is it due to the Association not having consistently lived up to the standard of the past? Is it due to the quality of the papers not having consistently been up to that of bygone times? There should be introspection before attempting to increase obligations by holding additional meetings. The value of the meetings already held should be by some means—whether by those suggested by the President, or in other ways, is a matter for determination—first enhanced; and this alone, without increasing the number of meetings, is worth the very serious consideration of the members.

As to contributions to inaugurate discussions, the idea of Mr. Webb regarding shorter papers and notes is good. The proposal should first of all be generally tried at the next few ordinary meetings. If some topic were selected well beforehand, several members might contribute their experiences regarding it in the form of prepared short notes, which would likely contain more information than many of the extempore utterances that at present pass for contributions to discussions at some of the technical meetings. There is another method of realizing proper discussions of current topics, and that is when a particularly appropriate paper is read at an Institution meeting, or at a meeting of any one of the District Associations, for that paper to be utilized as the basis of discussion at the meetings of all the District Associations. This is done by the District Sections of the Institution of Electrical Engineers; and, by this practice, views and experiences on the topic are secured from different quarters of the profession, and duly placed on record. We are confident there is much that might be done to raise the usefulness and efficiency of our District Association meetings. It is so easy to fall away from past standards that are good; the difficulty of maintaining the standards is great. The reason is that, in Association work, there is nothing in the way of personal concrete obligation, the same as there is in regard to the duties of a remunerated office. Members are not all fully alive to the obligations that they take upon themselves by membership; and this want of appreciation is the bugbear of an honorary secretary's life. To add to an honorary secretary's anxieties by an increase in the number of meetings, and the labour involved by every meeting—well, may it be forbidden, until the utmost is made of the meetings that are provided for by the existing rules.

The President also dealt with many works and commercial topics; and his experiences, views, and suggestions will be found of a highly practical and useful nature. But the subject to which he gave first place in his address is the one that suggested comment; and so, with a word of commendation to consideration of the remaining topics, we must leave what must be regarded as an eminently appropriate deliverance from the occupant of the Midland presidential chair.

Washing with Oil for Benzol and Toluol.

The country and her Allies need benzol as well as toluol; and it happens that British gas undertakings and coke-oven plants are in a superior position to those of any of the Allied countries for producing and delivering these necessaries in the largest volume. France has been deprived of the services of the chief coke-oven plants in Flanders; and unfortunately her loss is Germany's gain. France must not suffer from this cause, while this country is in a position to alleviate her loss. The appeal for the production of more benzol was reiterated, at the meeting of the Midland Association of Gas Engineers and Managers last Thursday, by Mr. John Bond, of Southport, who has taken an excellent part in the operations of the High Explosives Department not only by word of mouth, but by actual work and example at Southport. He told the members of the Association that the position in regard to toluol, through the application of the "C" process, is most satisfactory, and that about 25 per cent. of the toluol content of gas is being extracted at the present time. But there is the requirement for benzol; and this is what he attended the meeting chiefly to talk about, in order to stimulate interest in the matter, and to give information as to the simple method that he has applied at Southport so as, with the hearty support of his Committee and the Corporation, to do his share in assisting in providing benzol. On the same occasion Mr. Hubert Pooley, of Leicester, supplied particulars as to his working experiences in benzol extraction with green oil, in one section of the Aylestone Road Gas-Works. But Mr. Pooley was there to give information, and not to advise—though he had obtained remarkable benzol and toluol results—that green-oil washing should be generally adopted. Green oil is difficult to get in large quantities; there is no money in its use; the effect on the illuminating power and the calorific value of the gas is disastrous, and, in consequence, he has had to compensate for this by the aid of his carburetted water-gas plant, and by reducing the make of gas per ton of coal in another section of the works. Both of these compensating processes mean money with oil and coal at current high prices.

At Southport, on the other hand, American gas oil is being used. Although the oil is expensive, benzol is a necessity; and it all depends on the price secured for this

whether the process pays. Mr. Bond obtains 8½d. per gallon for the crude benzol. As will be remarked from the diagram published elsewhere in this issue, the plant required is of a very simple character; and at Southport old apparatus has been largely utilized. The method of circulating the oil is described in the report of Mr. Bond's remarks; and the work it will be seen has to be done in a systematic manner or there is a considerable loss in benzol recovery. The oil is circulated at the rate of 6 gallons per 1000 cubic feet of gas for six hours, from which time there is a falling-off in the extraction of benzol and toluol. Heating the oil, by the aid of a Wilton's dehydrating coil and a steam-jet, to a temperature of 110° C., the whole of the crude benzol is recovered from the oil. There is comparatively little loss of oil in the process. Up to the present no depreciation in the efficiency of the oil has been observed. When, if ever, it becomes spent, Mr. Bond is proposing to try the effect of using it in the carburetted water-gas plant. Another point of interest is that the oil takes up a considerable quantity of naphthalene; and since the process has been in use, only about 5 grains of naphthalene per 100 cubic feet of gas has been found at the inlet of the purifiers. Mr. Bond's position in this respect will be envied by many who are suffering from increased naphthalene trouble, to whatever cause it is attributable. But there is one point about the use of American gas oil upon which more information is desirable; and it is that the toluol extracted by it, according to the statement by Mr. E. W. Smith of the experiences at Nechells, contains too high a percentage of paraffins. This is a point to which Mr. Bond does not appear to have referred.

As to results, with the American gas oil process at Southport about 4 lbs. of benzol and toluol are extracted from the gas made per ton of coal. It has reached 6 lbs.; but the lower figure is about the normal one. With more drastic green oil treatment, Mr. Pooley recovered (according to the test of one sample of oil) 13·6 lbs. of benzene and 5·28 lbs. of toluene; and Dr. Colman's tests from the same sample showed 13 lbs. of benzene, and 3·9 lbs. of toluene—the discrepancy being partly accounted for by an irregularity in the thermometers. Over an extended period, Mr. Pooley obtained from the gas per ton of coal an average of 1·02 gallons of benzene, and 0·28 gallon of toluene, which are equal to 9 lbs. of benzene and 2·7 lbs. of toluene. These are high figures, and hence the effect on the illuminating and calorific power of the gas, which necessitated the utilization of carburetted water gas and the reduction of the make of coal gas per ton in another section, in order to build-up the impoverished gas. But at Southport, with a recovery of 4 lbs. of benzol and toluol, the illuminating power was reduced from 16 to 13½ candles and the calorific value from 530 to 490 B.Th.U. net. This is a gas of which no consumer utilizing it in proper ways can complain.

Southport has gone to considerable expense in this matter of helping the country; and those in authority in the Gas Department there, under the advice of Mr. Bond, have no intention, statutory prescriptions notwithstanding, to retrace their steps after the war. The country has had need of the services of the department; and those services have proved the sufficiency of the gas that is now being supplied. Following the war, the interests of the country will best be served by the availability of all the products in large quantities that the washing of gas by oil will provide. The war has put every gas undertaking into the position of being a concern not only of local importance, but of national importance. Every undertaking has had disclosed to it through the war a larger sphere of usefulness, not only in connection with the provision of materials for explosives making, but in connection with dyes and motor fuel. And, as we were recently remarking, the war is providing the evidence to lay before Parliament that the time has come when greater liberty in respect of gas supply will be to the best possible advantage of the general interests. Those gas engineers who fear the inroads of electricity through any interference with conventional qualities are simply rejecting the realization of the weapon that will give them larger competitive power in the future.

For the meeting, Mr. George Stevenson, of Long Eaton, had prepared a paper on "Toluol and the Limestone "Process." But time was against its adequate discussion. Therefore it was decided to have the paper published; and there will probably be discussion upon it at a meeting in May, which will, owing to current conditions, take the place of the usual visit, which would, under ordinary circumstances, have been to Stourbridge. The pleasure of the visit there, it should be said, is only deferred, and not annulled by current conditions. It will be observed from Mr. Stevenson's paper that, after the adoption of the limestone process, tests of the tar showed that the yield in pounds of toluene and benzene considerably improved per ton of coal carbonized. Samples of coke also showed but a faint splash of white here and there on the surface, owing to the use of the limestone, but there were no internal indications of it. This is due to the limestone being applied finely ground, and not in coarse form. If it were in the latter condition, the indications would be stronger. The point that has therefore been made, that the coke is depreciated in appearance by the limestone, is not confirmed by these samples.

In the Interests of Coke Producers.

The Engineer and Fuel Expert of the London Coke Sales Committee (Mr. E. W. L. Nicol) has previously proved himself so adept in the art of imparting interest to even such a superficially dull subject as coke, that it is unnecessary to refer to this quality of the paper that he read before the London and Southern District Junior Gas Association on Friday evening last. The paper possessed two other qualities. One was that it was highly instructive, and the other that it was excellent in suggestiveness. The juniors of the gas industry require instruction from one who is (so to speak) "in the swim" in all the matters appertaining to fuel characteristics and requirements in connection with steam-raising. We are not disposed to hide the truth that, as fuel users, because they are fuel producers, the gas industry has been distinctly wasteful. It has largely improved its position in respect of fuel consumption for carbonization, through more scientific construction and methods of heating. But it has not yet done all in this particular direction that it might do by automatic regulation of the primary air supply to its retort-furnaces. In the boiler-houses, there is no real or noticeable attempt at fuel economy. There is the fuel; fresh supplies are taken, in most cases, just as they are wanted; and there the matter ends. More is the pity, because from the extensive use of coke breeze and dust on gas-works for steam-raising, a very large experience should have yielded invaluable data for employment in the campaign for extending the utilization of coke for steam-raising in the industries generally. Fuel waste for this purpose extends to several other industries. Mr. Nicol pointed out to the Southern Juniors several places where there is to be found the defect of uneconomy, and where old errors are perpetuated in the purchase of boiler fuel; also why thermal units are not the only factor to be taken into account in assessing the value of a fuel, but fixed and volatile hydrocarbons should not be ignored, and how it is that gas coke has merits for industrial purposes that are not appreciated as they ought to have been.

Whose fault is this? It is largely that of the gas industry, through for generations marketing coke without any care as to the uses to which it is put, and without any heed as to whether efficiency or the contrary governed its employment, or whether it was supplied in the best form for application. It was then considered to be no business of the gas industry to do anything other than get rid of the coke to the best possible monetary advantage. For this heedlessness, the coke market was suffering acutely before the war started; to this heedlessness is due the birth of the London Coke Sales Committee, and the appointment of Mr. Nicol as their expert. These are two happenings for which we feel under an obligation to the heedlessness—nothing more. But the time has come when producers of coke—the gas industry and the coke-oven industry—must do more than they have done in the past to develop their markets. Gas coke is doing well now; but sight must not be lost of the fact that clear coke yards are due to the war, and to the shortage of available fuel owing to the state of labour at the coal mines. The times are coming when these favourable conditions for coke will be altered. Fuel economy, too, is being preached up and down the country; and coke producers must have a care that, if anything definite in the way of fuel control comes along, they have established a right to be heard, to take part in, and to benefit from, anything that is done. They must look to it that their interests do not go astray or be overlooked through any indulgence of the sense of a present security.

Now Mr. Nicol makes a suggestion by which coke could better establish its position in the industries. Steam-raising

supplies a large outlet for coke; but, to efficiently utilize it for the purpose, it is necessary that certain inexpensive appliances should be developed. It is pointed out by Mr. Nicol that the relatively high cost of forced-draught apparatus necessary to burn coke at a high temperature is largely responsible for the comparatively limited market and, in relation to its thermal value, poor prices realized for coke in the past. Coke producers ought not to be content to let things remain as they are; they ought not to be content to let the improvement of the status of coke as a fuel in industry rest upon individual enterprise in attempting to develop cheaper and more efficient appliances; and they ought not to leave the collection of data to anyone who chooses to collect, and who probably has very ill-defined information as to the conditions under which the data are secured. Systematized work in apparatus development and testing, and data collection, is necessary to the future of the coke market; and Mr. Nicol holds that this should be a matter for conjoint effort and financing between the gas and coke-oven industries. Sulphate of ammonia has its Association, and is financed by the producers for commercial purposes. There is, however, something more than trading watchfulness required in connection with coke. It has an important technical side, the interests of which will always be neglected unless some such scheme is adopted as that which is now adumbrated. The financing is the most difficult part; with money at hand for the purposes in view, the rest would be quite easy.

Mr. Nicol is suggesting that a modest subscription of 1s. per 100 tons of coal carbonized by the gas and coke-oven concerns interested would form the nucleus of a fund to provide the necessary means and incentive to inventors in this direction. "Without effort and incentive of this de-"scription, the use of surplus oven and gas coke may con-"tinue to be more or less limited to low-temperature appa-"ratus." The money side of the suggestion is admittedly modest, looked at from the shilling per 100 tons point of view, and not from that of the total. We do not believe in parsimony in such matters; but we think that the subscription might be still more modest, and yet effect what the proposer has in view. Some 36 million tons of coal are carbonized by the gas and coke-oven industries in a year; and the yield of 1s. per 100 tons would be £18,000. We cannot imagine this sum would be needed annually. It is a large amount; and with such a yearly income, the two industries might almost set about fitting up forced-draught apparatus to boilers free. With £18,000 a year, if there were no other claims on the money, 2850 furnaces could be equipped with apparatus at £6 6s. each. However, Mr. Nicol's scheme is one which should be very seriously considered, for it is really modest, and its potentialities are far-reaching.

What of the Institution of Gas Engineers?

It is a singular thing that, no matter what is being done of a public nature in which scientific and technical societies are concerned, the name of the Institution of Gas Engineers rarely figures. Yet if the Government wants high explosives, acids, and other chemicals, the gas industry is applied to, and urged to do its best to supply, and so show its patriotism. Even at a time when it is straining the constitution of its prime commodity to assist the country, and just when it ought to be recognized more than ever as one of the great indispensable industries of the country, it is bye-passed, and no regard is paid to it. Its productions, too, supply to various other industries their raw material, over which a great deal of scientific energy is expended. But who cares? When there is talk of organizing science, and when the Royal Society calls a meeting to consider the establishing of a conjoint board of scientific societies for the purpose of organizing scientific effort in the country, all the other principal technical and scientific societies appear in the published report as having been represented, but search is made in vain for the name of the Institution of Gas Engineers. Yet the meeting considered that a conjoint board was required to promote the co-opeation of those interested in pure and applied science. The gas industry is much interested in applied science. It is also interested in the "means by which the scientific opinion of the country may on matters relating to science, industry, and education find effective expression." It is also concerned in "taking such action as may be necessary to promote the application of science to our industries and to the service of the nation." Yet, we repeat, it is not stated in the report of the meeting that the gas industry was represented. The Institution of Electrical Engineers was. A Committee has been appointed to draft a scheme for giving effect to the resolution, and to report at a future meeting. There are several "Fellows of the Royal Society" identified with the gas industry. Therefore, if the existence of the industry has been forgotten, and thus representation not invited, perhaps the matter can still be adjusted.

Australian Gas Undertakings.

As might have been expected, the gas industry in Australia is finding itself confronted with some of the same difficulties as have, on this side, contributed to give directors, committee men, and officials an exceedingly trying time. In Melbourne, for instance, there have been higher prices for coal, increases in wages, and an enhancement of the cost of all material required for repairs or use at the works, or for distribution purposes. Freight charges are naturally disagreeably high. But business still goes ahead, an increase of close upon 8 per cent. being reported in the sale of gas during the past twelve months, as compared with 1914. The percentage increase of the consumption, too, was more than twice that of the number of meters fixed—an important consideration from the profit point of view. In the case of Sydney, it was stated at the half-yearly meeting that the Australian Gaslight Company had experienced a slight decrease in the consumption of gas, though there was a substantial increase in the number of consumers. In addition to the unavoidable cares, the Company were called upon to devote attention to an inquiry into the price of gas by the Necessary Commodities Control Commission. This inquiry the Board naturally regarded as somewhat inopportune; their opinion being that when the war is finished will be plenty of time for the Commission to think of revising their previous decision on the subject. Another matter calling for special attention was an application by the men (on the expiration of their agreement with the Company) to the Wages Board for a new agreement and an award. Lastly, there was the claim against the Government for compensation in respect of certain property taken over. This has been settled, after hard work on the part of the staff, which was warmly acknowledged by the Chairman. Readers will notice one point of similarity in the reports of the proceedings at the meetings of the two Companies, and that is the testimony they bear to the noble manner in which the employees have come forward at the call of duty.

Salty Coals and Refractory Materials.

Before the Coke-Oven Managers' Association last Saturday, Professor John W. Cobb discussed the effect of salty coals upon the walls of coke-ovens, and, of course, what he had to say applies equally to other coal-carbonizing structures composed of fire-clay material. The paper was more theoretical and directive than conclusive; and Professor Cobb would have what he puts forward taken as a basis from which manufacturers of fire-clay material should make further investigation and practical experiment. In dealing with the interaction that occurs between the volatilized salt and the fire-clay walls which has such disastrous effect, he dismissed the assumption that the action, or even the repeated action of sodium chloride on the surface of fire-clay has necessarily any very detrimental effects. There would be comparative immunity from destruction if the salt vapour could be kept from contact with the fire-clay face until the temperature of this was so high—say 1200° C.—that any compound formed was in a state of fusion. If sodium chloride is allowed contact at temperatures below this, the result is quite different, and much more serious. What, in Professor Cobb's opinion, happens is this: At a comparatively low temperature, the salt in the atmosphere of coal gas volatilizes, and, penetrating into the brickwork, combines with its substance. In so doing, it alters physically and chemically the composition of the portion of the wall nearest the face. The temperature of the brickwork is lowest near the face, highest near the combustion flues, and rises gradually from one to the other. Near the face the temperature is not sufficiently high to fuse the soda alumina silica compounds formed there. But these compounds have also formed further in, where a point is reached where the temperature is high enough to effect fusion—to produce liquidity, porosity, honeycombing, and rottenness of structure, making for disintegration. As a consequence of the chemical alteration in the portion of the fire-brick into which the salt vapour has penetrated, there is an accompanying physical

change in the co-efficient of expansion which may have considerable influence. If the outer layer is expanding and contracting every time the oven is heated and cooled, to an appreciably different extent from the substance at the back of it, this is, in itself, a disintegrating force.

Suggestions.

Professor Cobb does not put forward any remedy, but indicates the lines on which a cure could possibly be effected. It is obviously advisable to minimize the amount of penetration through the face by the use of practically non-porous material. But complete exclusion can hardly be hoped for. To realize this, the face should be close-grained, and the face and sizes so exact as to allow the use of small joints. Then the substance should be of a composition physically and chemically best adapted to resist the fluxing action of the salt. Free silica in the brick requires special consideration, because it may act in directly opposite ways. If it is very finely divided, so as to bring it into effective contact with the clay material, the silicate of alumina fluxing is enhanced. If, on the other hand, the silica grains are large, the fluxing action of the salt is confined largely to their exterior, and a state of affairs is readily attained in which the clay and fine silica, attacked by the salt, have formed a pasty mass, stiffened and strengthened by the silica grains. The beneficial effect of large-grained silica is due to the minimizing of its interaction with the other material present, which can only take place upon the interfaces of particles.

Lighting Glassware Shortage.

The war has turned glassware for lighting purposes, which was at one time considered in the gas industry chiefly from the commercial and æsthetic points of view, into a pressing problem. Supplies were always plentiful at one time, and the range of patterns from which to make selection one to which no exception could possibly be taken. Thanks for these conditions were almost entirely due to what are now enemy countries, and not to the enterprise of our own manufacturers. Glassware for the lighting industry—the gas industry requires annually an immense amount of glass of good heat-resisting quality—is one of the country's missed opportunities. But glassmakers at home are now doing their best, under the restrictions of current circumstances, to put something into the "aching void" from which the lighting industries are now suffering; and it is hoped that time will enable them to do more and more, until the country is practically self-reliant in this respect. The difficulties of the situation are such that the Illuminating Engineering Society last Tuesday descended from its scientific platform to consider British glassware manufacturing conditions; and those conditions, as a result of the discussion, are seen to be hopeful, if not exactly brilliantly so. The discussion was raised on a paper by Mr. S. B. Langlands, from which, together with the speeches, it was made abundantly clear that, if the lighting industry is to be self-supporting in respect of lighting glassware, then it is necessary that there should be co-operation between manufacturers and buyers, through organized means, instead of the isolation of the one from the other which now exists. [Unfortunately, our report of the proceedings is crowded out this week.]

Need and Standardization.

The manufacturers do not seem to know precisely what the lighting industry wants; and the lighting industry has taken no positive steps to inform them, beyond piling on them such a mountain of designs and an almost innumerable assortment of shapes and sizes that the manufacturers simply stand aghast, and very properly ask whether something cannot be done, under the circumstances of the want of a sufficiency of plant, skilled labour, &c., in the way of the regulation of requirement. Mr. Langlands is strong on standardization. Standardization in some ways would be good, but only in others as a temporary expedient. For instance, there has been such a variety of pattern at command in the past, that it is hoped the condition will not be permanently withdrawn, but will be, within reason, re-established in time by our own manufacturers. If not, there can only be one result later on. If, however, makers of burners would standardize their productions so as to reduce the number of sizes of globes, glasses, &c., required, this would be a decided advantage. As to the chemical composition of glass, we hope the manufacturers will themselves ascertain the best standard for high temperature work, and then live up to it; and if further research shows that the hitherto "best" is capable of being exceeded, then it will only mean that a fresh standard has been established, and for it there will be thankfulness. There are many points in the paper and discussion which will interest readers in regard to this pressing matter, in which shortage and high prices have wakened a new and lively interest.

EDWARD ALLEN, JUNIOR.

Much sympathy will be extended by the gas industry to Mrs. Allen and family, in the death of the eldest son, Edward, which occurred at his residence in Bootle early last Sunday week, after only a few days' illness from pneumonia, at the early age of 38.

Mr. Allen, junior, had been identified with the Liverpool Gas Company for many years; for it was in their works, shops, and drawing office that he received his training, after having been educated at the Birkenhead Institute. He entered apprenticeship with the Company in 1894; and was appointed Junior Draughtsman in 1899, and Chief Draughtsman in 1904. Valuable experience was gained by him in the latter capacity, in connection with the extensive additions and alterations to the works and plant of the Company carried out during recent years. In the changes consequent on his father's death, he was appointed Superintendent at the Company's Linacre works, a position for which his all-round capability well qualified him. In fact, he could fill the Superintendent's position in any department of the Company at short notice, which he was at times called upon to do. Holding himself a number of certificates in technical subjects, he had for the last two years filled with considerable success the position of Lecturer in "Gas Supply" under the Liverpool Education Committee. In 1914, he was admitted a member of the Institution of Gas Engineers.

Although of a quiet and retiring disposition, Mr. Allen was a great favourite with the staff—possessing a courteous and pleasing manner, and being ever ready to assist his colleagues and co-operate with them in all good works. A large circle of friends received the news of his death with very deep regret.

In a letter full of sympathy with the bereaved relatives, Mr. Edwin Upton, Treasurer of the Liverpool Gas Company, says: "At the funeral, the chief mourner was another Edward Allen—a little fellow of thirteen summers, whose childish dignity in a trying situation gives promise. His little soul had doubtless been stirred by a mother's anguish; and he had formed a resolution to be a man henceforward. Thus grief follows grief almost with tragedy; and a wife with four little ones—their ages are respectively thirteen, nine, four, and two years—are left to the cold winds of a chilly world. Yet there is the consolation to the looker-on, that from out these trials there rise some of the best of our manhood; and the writer has a strong faith that the great charity, bountiful deeds, and true benevolence of the grandfather of these little ones will not perish."

LIEUTENANT C. V. TOWNSEND.

Second Lieutenant C. V. Townsend, of the 7th King's Shropshire Light Infantry, was killed in action in France on Tuesday night, the 21st inst. He was 28 years of age, and single. In civil life, he was Engineer and Manager of the Hereford Corporation Gas-Works. Lieutenant Townsend was the second son of Mr. Henry Townsend, Managing-Director of the Wakefield Gaslight Company. He was educated at the Wakefield Grammar School, and having served his articles to his father was for a short period Draughtsman to Messrs. Drakes Limited, Gas Engineers, of Halifax, and then for some years Assistant Engineer and Manager to the Wakefield Gaslight Company, leaving at Christmas, 1913, to succeed his elder brother as Engineer and Manager at Hereford. Upon the outbreak of the war, having had four years' training in the 4th K.O.Y.L.I. Territorial Force, which he left with the rank of Sergeant, he considered it his duty to offer his services to his country, and enlisted in the Grenadier Guards. He served six months in the ranks, from which he was given a Commission in the 7th K.S.L.I.

Two of his brother officers have sent particulars of his death. Second Lieutenant L. M. Dell says Lieutenant Townsend was in charge of a small patrol, who left the trenches about 10 at night to have a look about. They crawled round the German wire for some 100 yards, and got back safely to their own wire, when a grenade suddenly exploded, killing Lieutenant Townsend. He lived about ten minutes, but was not conscious. Stretcher bearers were got out of the trench in a couple of minutes, and everything was done that was possible; but he had no chance. He was hit in the head. One of his feats was to cut a section of German barbed wire out of their defences, and bring it home. It was sent to Army Headquarters; and the Division wrote thanking the regiment for the information obtained. He had always been the leader of all the patrols; and his men had done more damage to the "Huns," and got more intelligence, than all the rest put

together. He was always a very careful man, with no nerves at all; and as far as could be seen not the slightest fear. He was known as absolutely the coolest man in the Battalion. Everyone in the Battalion always counted him as its best officer for any dangerous work. Second Lieutenant A. W. Johns says: "Whenever any patrolling had to be done, both of us nearly always went out together; and I was never in fear so long as he was with us, because he gave me such confidence that I knew we would always come out on top when we met an enemy patrol. He was very popular with all of us, and an excellent officer in every way."

We heard yesterday afternoon from Mr. Townsend that he had received a letter from Lieutenant-Colonel R. E. Negus, the Commanding Officer of the Battalion, stating that Lieutenant Townsend was shot while patrolling on the night of March 21, and survived a few minutes only. The writer adds: "He was one of the bravest men I have met, and had performed such splendid services in obtaining information and in inflicting loss on the enemy, that I submitted his name recently for mention in despatches. He was universally popular with the officers and men, and cannot be replaced. Will you please accept on behalf of the Battalion our most profound sympathy. I am attending his burial, and representing the regiment."

PERSONAL.

We learn that Mr. HARRY E. JONES has been elected a Vice-President of the Institution of Civil Engineers.

Mr. A. M'ALPINE, of Aberfeldy, has been appointed Manager of the Pitlochry Gas-Works, in place of Mr. J. LETHAM, who is now Manager of the gas-works at Leslie.

Mr. RALPH HALKETT, the Commercial Superintendent of the Glasgow Corporation Gas Department, has accepted the post of Honorary Examiner in Gas Supply for the Royal Technical College of Glasgow—a new post necessitated by the formation of classes in "Gas Supply."

The Cowes Urban District Council received 103 applications for the vacant managership of the gas-works (caused by the death of Mr. E. H. Millard). After interviewing three candidates, Mr. HENRY BUTTERFIELD, the Manager of the Swadlincote District Council's Gas-Works, was appointed.

Mr. C. M. WILSON, the Chief Assistant of Mr. R. W. Edwards, the General Manager of the Aldershot Gas, Water, and District Lighting Company, has accepted a Commission as Lieutenant in the Army Ordnance Corps, Inspector of Machinery; and Mr. A. VINCENT BARRACLOUGH has been appointed his successor.

Chief Petty Officer W. J. LIBERTY, Public Lighting Inspector to the City of London, of Lord Fisher's Department (Board of Invention and Research), has been rated-up by the Admiralty from the Royal Naval Volunteer Reserve to the Royal Naval Air Service, and transferred to the Admiralty Air Department, under Admiral C. L. Vaughan Lee.

A special meeting of the Executive Committee of the Canadian Gas Association was held in Toronto on Feb. 19, at which the resignation of Mr. JOHN KEILLOR as Secretary-Treasurer was accepted, and Mr. GEORGE W. ALLEN, of the Toronto Consumers' Gas Company, was appointed to succeed him. Mr. Keillor was to have left Hamilton (Ontario) early this month to take up the position of Superintendent of the Vancouver Gas Company.

Some New Committees.

The creation of further Committees, entrusted with various tasks, was announced during the past week. In the first place, it was intimated that the President of the Board of Trade had decided to appoint Committees to consider the position of certain important British industries after the war—especially in relation to international competition—and to report what measures (if any) are necessary or desirable in order to safeguard that position. So far, two of these Committees have been constituted. One is for the iron, steel, and engineering industries, with Sir Clarendon Hyde as Chairman, and Sir Hallewell Rogers one of the members. The other is for the shipping and shipbuilding industries, with Sir A. A. Booth, Bart., as Chairman. The constitution of a Committee for the textile industries is to be announced shortly. Then the Advisory Council for Scientific and Industrial Research announce that, in order that they may be in a position to do justice to the industries concerned in proposed researches submitted to them, it has been decided to appoint Standing Committees of Experts. Committees in Mining and Metallurgy have already been formed—each with two sections. Sir William Garforth has accepted the chairmanship of the Mining Committee and the Non-Metals Section; and Mr. Edgar Taylor will be Chairman of the Metals Section. The Metallurgy Committee will have as Chairman of the Committee and of the Non-Ferrous Section Sir Gerard Muntz, Bart.; and of the Ferrous Section, Sir Robert Hadfield, F.R.S. A similar Committee for engineeing is in contemplation. Grants are being made to various technical institutions, to enable them to continue researches already in progress. One branch of the Advisory Council's work is to train an adequate supply of research workers.

RESERVATION OF ESSENTIAL MEN.

The Present Position Explained.

THE application made, on behalf of the gas industry, to the Board of Trade Committee on Reserved Occupations has been considered by that Committee, who have heard in its support representatives of the Institution of Gas Engineers, of the British Commercial Gas Association, and of the Society of British Gas Industries.

The Committee, which in view of the urgent need for more recruits is being pressed by the Government to revise quickly and thoroughly the list of "Reserved Occupations" in the direction of limiting, rather than widening, the present exemptions, showed itself, and undoubtedly remains, very averse from altering the wording respecting gas-works in the latest list. At the same time, its members recognize the importance of maintaining the output of gas.

To this end, they, at their last revision, included in the list of men engaged in "Reserved Occupations" all workmen inside gas-works (relying with good reason upon the patriotism of gas managers for the release of every fit man of military age inside the works who could possibly be spared or replaced temporarily), and hoped, as they were given to understand, that, with this concession granted, the industry would be able to manage to keep the outside work going by boys, women, and over-age men.

The Committee, however, pointed out in discussion in regard to outdoor men, the important fact that under the "General Exemptions in All Industries" are included:

"Mechanics, &c.:—

(2) Other mechanics and similar men engaged in the maintenance and repair of plant, machinery, and tools."

And they ruled that mechanics engaged in the maintenance and repair of gas mains and services (including those employed in removing naphthalene deposits) are covered by this general reservation. If therefore the Military Authorities will not agree to refrain from calling up a man so engaged, appeals could be made to Local Tribunals on those grounds, and carried to the County Appeal Tribunal if unsuccessful in the first instance. There is a further appeal (by leave of the County Appeal Tribunal) to the Central Authority in London. It might well be, and was argued, that maintenance and repair of plant in the case of a gas undertaking must include the maintenance and repair of meters, stoves, and other gas-consuming appliances; but the Committee would not endorse this interpretation of the general exemptions. The Committee pointed out, however, that it was open to any undertaking to appeal in respect of any man regarded as absolutely indispensable whatever his particular work might be.

In support of any appeal for indispensable outdoor men, it would, of course, be pointed out that in so far as the ingredients of high explosives (toluol and benzol) are produced as a bye-product of gas manufacture, the output thereof is necessarily strictly proportionate to the quantity of gas made, and that the manufacture of gas can only be maintained if the appliances necessary to its distribution and consumption are either kept in working order or replaced when worn out. The following statement made by Mr. Lloyd George on Nov. 9, 1915, as reported in the "Daily Chronicle," could be quoted in support of any appeal for an indispensable man whatever his grade.

MR. LLOYD GEORGE'S NEW DIFFICULTY.

TOO MANY MEN LEAVING GAS AND ELECTRICITY COMPANIES.

The Minister desires to point out that such companies are engaged upon work of vital importance and that *the removal of their employees even to munition work may frequently have the effect of prejudicing the output of munitions of war.* He invites employers to assist him by refraining from attracting labour from these essential undertakings.

In regard to clerks, and others in administrative positions, who for particular reasons, are quite irreplaceable, the following extracts from the new "Instructions to Local and Appeal Tribunals" issued last Friday from the Local Government Board may be noted:

(7) In deciding cases which come before them, tribunals should recognize the injury that may be done to the industries and commerce of this country if managers directing important businesses (including managing proprietors and managing directors), and clerks possessing technical knowledge, or otherwise occupying positions of special responsibility, are removed from their present employment and cannot be replaced. The same considerations will apply to the case of men who are the directing heads of farming and other agricultural operations. The number of men who come within these classes is comparatively small, but the loss to branches of industry and commerce which supply the sinews of war would cause damage to the economic welfare of the country out of all proportion to the gain to the Army.

On this point the following suggestions are offered. The directing head of every considerable business of real national importance should be given exemption from military service. If there is more than one directing head, the tribunal should consider whether the business is of such a size or complexity that more than one head is essential. The tribunal will have to determine in doubtful cases whether any person claiming exemption is in a controlling position, and whether no efficient substitute can be found. In settling this question, the age of the applicant and the length of his experience in the business should be taken into

account. Thus, as a general rule, it may be assumed that men less than 30 years of age, particularly those with a small financial interest in the business, are not indispensable as directing heads. As regards small businesses, the tribunal must decide whether or not the claim for retention is reasonable.

In cases in which the time for appeal has lapsed, but the men have not yet joined the Colours, the time for appealing might reasonably be extended.

In dealing with these as with other cases, it is, of course, essential to bear in mind the urgent needs of the Army for men.

(8) Attention is also drawn to the case of responsible and directing clerks in certain establishments. Reference has previously been made to clerks in industrial establishments (see footnote to the list of certified occupations).* It has, however, been represented that the case of clerks in shipping offices, export houses, banks, insurance offices, and other large commercial establishments is somewhat different, as clerks here form a majority, or a large proportion, of the entire staffs.

In these cases it is very difficult for the military representatives, or the tribunals to arrive at a decision whether an individual clerk is really indispensable or not without technical knowledge of the businesses in question.

In the City of London, representative bodies concerned with great businesses, such as banks, have in various instances already been able to render valuable help by putting definite recommendations before the military representative based on a general survey of the whole field of their operations. Where this has been done, the task of the local tribunals is much simplified, and the establishment elsewhere, where possible, of the arrangements made in London is very desirable.

In presenting claims to the Local, the Appeal, or the Central Tribunal in respect of an absolutely indispensable man, it should be made clear that every possible effort has been made to find a substitute, and that every man on the works or the district or in the office that could possibly be spared—and not merely conveniently spared—had been allowed to enlist, and that women were being employed wherever possible.

Both by the Ministry of Munitions and by the Reserved Occupations Committee, the need for more men for the Army is plainly recognized as more than ever urgent; and every gas undertaking (in common now with every Government factory) has to be prepared to stand the most searching analysis of the men in its employment before it can get special assistance in retaining men of military age.

If, as the result of this new "winnowing" campaign, the gas industry finds itself threatened with so serious a handicap as would render it incapable of fulfilling its obligations both to the Ministry of Munitions and to the general public, further concerted action based on a volume of convincing evidence will have to be taken.

* (2) *Clerks in Industrial Establishments.*—In most industries there are certain clerks who are indispensable on account of their technical knowledge, their intimate acquaintance with their employer's business or the managerial and directing character of their work. It is impossible to separate these men by classification from other clerks who can be replaced, as the distinction depends upon the circumstances of the individual case rather than upon the description of the occupation. Needful exemptions must therefore be left to the local tribunals, after consideration of each case on its merits.

PRICE OF COAL (LIMITATION) ACT.

Sir,—I am instructed to forward to you for publication the enclosed copy of correspondence which has passed between the Institution of Gas Engineers and the Board of Trade with reference to the recent correspondence between Sir Thomas Ratcliffe-Ellis and the Board of Trade, with regard to the interpretation of the Price of Coal (Limitation) Act.*

W. T. Dunn, Secretary,
Institution of Gas Engineers.

39, *Victoria Street, S.W., March* 21, 1916.

[Enclosures.]

Institution of Gas Engineers, 39, *Victoria Street, S.W., March* 17, 1916.

W. F. Marwood, Esq., C.B.,
Board of Trade, 7, Whitehall Place, S.W.

Sir,—The attention of the Institution of Gas Engineers has been called to the correspondence which has recently passed between you and Sir Thomas Ratcliffe-Ellis, as to the interpretation of the Price of Coal (Limitation) Act. It is found that the collieries are interpreting this correspondence to mean that they have the right to take as the basis price in all cases the highest price obtained from any purchaser for similar quantities.

This, it seems, cannot be the true intention of the Act; for it would mean that in all cases buyers would have to pay the price most advantageous to the colliery—the result being that the colliery would obtain considerably more than 4s. per ton on the average. Furthermore, it would mean that if there had been exceptional circumstances which would warrant the obtaining of a higher price in any particular case, all buyers of the same coal would forfeit, although the same circumstances would not necessarily apply to their cases.

* The correspondence here referred to appeared in the issue of the "Journal" for March 7, p. 521.—Ed. J.G.L.

It is felt that the only way of giving real effect to the Act, and limiting the increased price to 4s. over the average, is that the price paid by an individual purchaser shall be compared, for the purposes of the Act, with the previous prices paid by that same purchaser (provided a purchase has been made). Otherwise, as pointed out above, by taking as the basis price the highest price obtained, the buyer would be heavily penalized.

Awaiting the favour of your reply.

(Signed) John Young, President.

Board of Trade, London, S.W., March 20, 1916.

The President, Institution of Gas Engineers,
39, Victoria Street, S.W.

Sir,—In reply to your letter of the 17th of March, regarding the Price of Coal (Limitation) Act, I am directed by the Board of Trade to state that while, as pointed out in their letter to Sir T. R. Ratcliffe-Ellis to which you refer, there is nothing in section 1 (1) of the Act requiring that reference should in all cases be made to sales to the same buyer, such sales would probably as a rule be more likely to have been made under similar "conditions affecting the sale" than sales to other buyers.

The exact determination of the corresponding price may sometimes be difficult; and the Board hope that both buyers and sellers will be ready to interpret the Act reasonably, and not require reference to contracts under which the price was either unusually high or unusually low, owing to special temporary circumstances which may have existed at the time.

The Board are always willing to offer an opinion on any case that may be referred to them by the parties.

(Signed) W. F. Marwood.

ELECTRICITY SUPPLY MEMORANDA.

Wiring Rules Revision.

Judging from the criticism that at intervals appears in the Electrical Press, the Institution of Electrical Engineers cannot claim to be a perfect body. Its works, according to the critics, are always open to improvement; and the necessary improvement is frequently a difficult matter. Of course, we know that human effort rarely does attain an unassailable perfection. But the Institution of Electrical Engineers appears to be particularly unfortunate. Even its wiring rules, with the experience that has accrued since 1882, have never been brought to a condition that could be accepted as perfect. The Institution has realized this itself. Rules, of course, require modifying as fresh advances are made; but the old wiring rules are constantly being tinkered about, which shows that there has existed defect in some particular or other. This is unfortunate, because, if rules as formerly existing were not all they ought to have been, then work that has been carried out scrupulously according to the prescription will also not be all that it should be. The seventh edition of the rules has now been issued in revised and extended form. While the "Electrical Review" congratulates the Wiring Rules Committee upon its work, it says that, on the whole, the rules are not yet beyond criticism; but it believes the changes that have been made in the regulations are such as will command general approval. They do not all command the approval of the "Electrical Times." A broad smile covered the face of the reviewer in the latter as he alighted on some of the fresh decrees. "Electrical Engineering," too, does not think the Institution was well advised in issuing the new edition just at the present time. This contemporary, we rather fancy, is of opinion that with the current mind-absorbing topics, electrical contractors and manufacturers will not give themselves up to a full and thorough study of the regulations. It certainly requires vast mental power to keep all the rules and their periodical modifications and extensions within mind. It is interesting to learn from the "Review" that all the Fire Insurance Companies have now adopted the Institution's rules.

Changes—Gas-Fittings and Electric Wiring.

Preceding editions of the rules have dealt with pressures not exceeding 250 volts; the present edition also covers medium pressures between 250 and 650 volts, which change has been necessitated [quoting the "Review"] by the amount of power that is supplied from the outers of three-wire systems and on three-phase networks at pressures between 400 and 500 volts. We cannot here notice all the changes made; a few will suffice. Among the new clauses is one providing that, where medium pressures are used, adequate precautions must be taken, either by earthing or other means, to prevent any metal other than a conductor from becoming electrically charged. It is also observed that where energy is used for purposes additional to lighting, and where failure of light may cause panic or be "otherwise dangerous," the lighting must be controlled by independent main fuses. It is hoped that there will be loyal observance of another new prescription to the effect that gas-pipes must not touch conductors, or their insulating material, metallic sheathing, or conduit, whether earthed or not; non-conducting pieces being necessary to separate them. There has been a large amount of

trouble through slovenly work across and contiguous to gas-piping. Then, again, it is provided that combined gas and electric light fittings are not to be used; and, if gas-fittings are adapted, they must be entirely disconnected from the gas-piping. On our part there is approval of these provisions. A clause that interdicted the use of dynamos, arc lamps, &c., in places where inflammable or explosive dust or gases are liable to exist has been modified by substituting mercury vapour for Nernst lamps. The facetious critic of the "Electrical Times" thinks this change may be due to patriotic motives. To the clause providing that metal conduits must be electrically and mechanically continuous throughout, there is now an addendum which explains that slip-joint conduits do not comply with this rule, but that some form of screw or grip joint is necessary to give ample and permanent electrical conductivity and rigidity throughout. For medium pressures, heavy gauge screwed conduits must be used. It is also recommended that conduit runs should be sloped to drainage positions.

Heaters and Irons.

The "Electrical Times" appears to deplore that the word "cooking" does not appear in the rules; but it finds consolation in thinking that the word "heaters" has a meaning that embraces cookers. It is also shocked over the short-sightedness of the drafters of a new clause providing that heaters rated at above 1000 watts must be fitted with double-pole switches. "If this rule be enforced," remarks our contemporary, "it will involve redesign for every heater on the market, for we have never yet come across a heater so controlled. Electric fires taking 3, 4, and even 6 KW. are now being sold, and are controlled in sections by single-pole switches." If safety demands double-pole switches, then double-pole switches there must be; but our contemporary is apparently of opinion that this rule will be honoured more in the breach than in the observance. We do not doubt it; indifference and neglect are common failings in connection with electric installation. It is thought that a similar fate awaits a clause providing that red pilot lights should be used in conjunction with non-luminous heaters and heating appliances, such as smoothing-irons. It is doubted whether the domestic user of electric flat-irons would go to the trouble to utilize pilot-lamps in this way, seeing that the irons are frequently employed in living rooms, and are connected to the lighting supply, so that, it is submitted, it would be difficult to arrange for a pilot lamp for temporary connections of this nature. Whether this is so or not does not dispose of the fact that a pilot lamp is preferable. The rules form an interesting study, if only to prove that there are a thousand-and-one loopholes by which the vaunted "safety" of electricity can escape, and danger succeed it.

Economy or Luxury.

The British Electric Transformer Company are the makers of the "Tricity" cooker, about which much less has been heard since one named Grogan ceased flitting about the country in its interests. Anent it, a curious confession was made by Mr. A. F. Berry, at the recent meeting of shareholders; and it is that there is a division of view as to the merits of this type of cooker. He said that, at the moment, "Tricity" cookers were looked upon by some as an economy; while others regarded them as a luxury. It is strange that we have never personally come into contact with any independent person who has really looked upon the "Tricity" cooker as an economy. This is our old friend the "biscuit-tin" form of electric cooker; and it is known that, as compared with some of the other forms, this one takes longer to heat up to a given temperature, and it certainly parts with its heat quicker than the thick iron-cased and well-lagged types, which seem to be coming into general favour among electricians. The electricity supply industry has veered round to an acceptance of the experience of the gas industry; if electric cooking is going to make headway for domestic purposes, it must show not only good economy, but the appliances must be equal to the hard wear of kitchen life and method. On the two grounds alone of (despite its highly polished surfaces) heat efficiency and durability, the "Tricity" cooker is, published experiment declares, outstripped by other makes, unless, of course, the statement of Mr. Berry that the Company are improving their designs means that they have something of which we are not aware that threatens to have the two essentials of high efficiency and long life. Meanwhile, it is interesting to note that Mr. Berry realizes that some people regard the "Tricity" cooker as a luxury. It is singular that that happens to be the view we have entertained from the time we first saw one at work.

The Uncertainty of "Safety."

There is a beautiful uncertainty about the safety of electricity. The terms do not exactly fit; but it is a fact that, though the safety of electric current and operation is lauded, the safety only continues so long as there is no sudden, mysterious, or other interruption of the condition. This is all that can be said. Of course, in papers read before electrical and mining organizations, electric operation in mines has nothing to approach it. Mr. H. Elliott, the Engineer of the Frickley Colliery, near Barnsley, said so in a paper he recently read before the Yorkshire Branch of the Association of Electrical Mining Engineers; but in effect he had to admit that there are a good many loopholes through which serious trouble can come. Now the conditions of coal mines are notoriously favourable for very bad accidents; and electrical plant is notoriously susceptible to derangement in ways that readily contribute to disaster. When, therefore, electrical plant is introduced into coal mines, two extremes meet. It is stated by Mr. Elliott that, when accidents have been directly caused by electricity, they have been generally due either to the plant installed being unsuitable for its work, or to being badly installed and maintained. Warning permeates the author's words: "Electricity cannot be trifled with in a pit; and unless it is intended to instal a suitable plant to commence with, and to see that it is properly maintained, an electrical plant should not be installed at all." This means skilled and frequent inspection. Mr. Elliott emphasized the necessity of the employment of a fully qualified mining electrical engineer; and of a proper system of inspecting and testing plant.

An Example.

Not far away from the place at Barnsley where Mr. Elliott's services are in daily request is the Central Silkstone Colliery; and just about the time he was reading his paper, a number of summonses found their way to various persons officially engaged at the colliery. The charges referred to in the summonses covered a large field; and part of them dealt with the electrical appliances used in the pit. There is an electrician in charge of the appliances; but nevertheless there was trouble. An explosion took place on Oct. 17. When an electric coal-cutting machine was being started to work, there was a flash from it, with the result that four men were more or less seriously injured. When the summonses were being heard, Mr. James Mellors, an Inspector of Mines, stated that he had not the slightest doubt that the explosion was due to the ignition of gas by flame from the cutting-machine. Yet, on behalf of the owners, it was submitted that they exercised every precaution. If this is so, then it is a confession that precaution will not avert danger with electrical machinery in a coal mine. The case for electrical operation was made even worse by the further statement, excuse, or whatever is the correct term for it, that the seam where the accident occurred is one where there is seldom, if ever, any trace of gas. Fines were imposed upon certain of the defendants. It is such cases as this that cause miners to look with suspicion upon electrical working, and consider that it introduces into collieries a fresh element of danger to workmen's lives. We have this view mirrored in the annual report of Mr. John Wadsworth, the General Secretary of the Yorkshire Miners' Association. He says it is his conviction that no electricity should be taken to the coal face in any coal-mine because of the risk of explosion in the event of a defect developing in the machinery or in the pit itself. The conditions that exist in coal-mines are not conducive to refined upkeep of electrical plant; and even in mines where there is the most scrupulous supervision of the plant, trouble has arisen in unexpected places and at unexpected times.

Economy in Criticism.

The "Electrician" calls its readers' attention to a passage in our recent editorial article on "Train Lighting and Uncorroborated Evidence." The passage is: "The Inspectors engaged in the work of other Government Departments do not appear to trouble themselves, though faced by a long roll of fatalities, regarding the expulsion from mines of electricity used for power purposes, with a recommendation that its place be taken by compressed air, or from factories and workshops, with a proposal that other forms of power with fewer mantraps associated with them should be adopted." Our contemporary remarks: "Till we read our contemporary, we had always imagined that, in comparison with the fatalities from gas explosions in mines, the electrical fatalities were negligibly small." Of course, our contemporary has been too busy to observe that of late years certain of the most life-robbing explosions in mines have been attributed to electrical causes. Then, it proceeds to state: "In comparison with the output, the electrical fatalities in our works and factories are also negligibly small." This is beautifully vague. "Negligibly small" is a convenient term; but its use in connection with the loss of life through electrical causes suggests an unpleasant callousness. However, our contemporary has had its say over one passage of the article on "Train Lighting and Uncorroborated Evidence." Perhaps now it will turn its attention to the other points that were made. We shall be very pleased to discuss them with our contemporary if it expresses any desire to do so.

A Dutch Work on the Chemistry of the Gas Industry.

We have received from the publishing house of J. B. Wolters, at Groningen, in Holland, a copy of a new work on the "Chemistry of the Gas Industry and the More Usual Methods of Analysis" ("De Scheikunde van het Gasbedrijff en de meest gebruikelijke Methoden van Onderzoek") by Heer G. A. Brender à Brandis, the Engineer of the Corporation Gas-Works at the Hague, and Reader at the Technical College at Delft. The work comprises 340 pages, and is divided into seven chapters, of which six refer to coal-gas manufacture and one to carburetted water-gas and oil gas. There are also a number of useful tables. A fuller review will be given in an early issue of the "JOURNAL" of the contents of this valuable text-book, the price of which is 7·90 florins—13s. 2d. at the normal rate of exchange.

FUEL ECONOMISTS.

By W. J. A. Butterfield, F.I.C., Assoc.Inst.C.E.

[*Concluded from p.* 628.]

Carbonization of Coal.

It is unnecessary in the "Journal" to deal exhaustively with the question of the merits of the carbonization of coal and the direct use of the resultant coke as boiler fuel, because most of the readers have already had opportunities of working it out for themselves. Whether it would pay to treat coal thus, solely with the object of using both the coke and the coal gas as boiler fuel in a large power station, is, however, a question which stands on a somewhat different footing. Gas-works and coke-oven works depend for their commercial success on being able to obtain for their primary products—gas in the one, and coke in the other case—a substantially higher price than the equivalent in heat units of coal, because coal gas and oven coke have great advantages over coal for special purposes. For the firing of large boilers, however, gas (as already demonstrated) has only a comparatively small advantage over raw coal, and coke has practically none. Carbonization involves, in practice, a loss of 15 to 25 per cent. of the calorific value of the coal carbonized; and if both the coke and the gas made are to be used merely as boiler fuel, it would appear that the tar, ammonia, and other bye-products recovered must pay for the greater part of this loss, and also for the working expenses and interest and depreciation charges on the carbonizing plant. If the tar is not used as boiler fuel, and benzol is extracted from the gas, the gas and available coke—whether made by high or low temperature carbonization—will represent only 65 to 75 per cent. of the calorific value of the raw coal, and, through them, therefore, not more than about 60 per cent. of this value would be utilized in boilers in the evaporation of water.

With regard to the return from tar and benzol, there is, in normal times, a limit to the prices obtainable for them, which depends on the competition of alternative materials or alternative sources of supply immediately that limit is reached. The only unlimited market for either of them which can be foreseen is the fuel market, though, for tar, road construction may be a valuable auxiliary outlet. The existing supplies already far exceed any possible requirements of the synthetic colour and drug industries, and, in normal times, of the explosives industry also. There is no question that carbonization of any large proportion of the raw coal now consumed for power purposes would yield quantities of tar and benzol so great that there would be no hope of their prices being maintained much above figures corresponding with their relative calorific values as compared with raw coal and petrol respectively. Independent carbonization of coal for the supply of gas and coke for use merely as boiler fuel seems out of the question; and fuel economists must suggest other schemes if they wish to displace the use of raw coal as a boiler fuel in large power stations.

If, however, the fuel economist will promote a much more extended use of coal gas as a domestic fuel and for many classes of furnace work (large boiler firing excepted) its value for these purposes is so much greater than the equivalent (in heat units) of raw coal, that a comparatively high price can be obtained for it. The large quantity of coke produced at the same time will then become available as a boiler fuel for large power stations at a price at which they can afford to buy it in competition with raw coal. But the fuel economist who adopts such a sensible view need not proceed to follow Professor Armstrong and academical theorists in condemning present gas-works' methods, which are condemned only by those who know the least about them from the standpoint of the chemist and engineer. The evolution of methods in the gas industry to meet the changing requirements of users of gas, and to recover useful bye-products, has been continuous and rapid; and the gibes of academical theorists merely bring discredit on their promulgators.

Carbonization of Coal and Gasification of Coke.

The carbonization of coal, and the gasification of the resultant coke, with the object of using the producer gas, with or without the coal gas, as a boiler fuel in large power stations, is a procedure which can only supersede the use of raw coal for the purpose if either the chief bye-products—tar, benzol, and ammonia—are saleable at abnormally high prices, or the coal gas is retained for sale for domestic use and the other purposes for which it is a superior fuel. As such, coal gas can command a high price, which will cover the heat losses on carbonization and the working expenses and capital charges on the carbonizing and recovery plant, a simpler, and less costly, type of producer can be used for the gasification of coke than for bituminous coal; and in a power station adjoining a gas-works it is quite conceivable that it might be worth while gasifying the coke instead of using it directly as a boiler fuel.

Conclusions.

Professor Armstrong's proposal that the use of raw coal as a domestic fuel should be forbidden—at latest ten years hence—coupled with his condemnation of gas coke is so far divorced from the sphere of practical affairs that it is unlikely to receive serious attention even from men who have no technical knowledge of the fuel industries. Fuel economists of a practical turn of mind will do best to encourage by all means in their power the extension of the use of gas as a domestic fuel. Where solid fuel cannot be wholly displaced, gas coke and coke briquettes should be substituted as far as possible for raw coal; but when the latter must be retained, every effort should be made to enforce the adoption of economical grates and ranges.

As regards the use of raw coal for power purposes, economists may aid its abolition by encouraging efforts to improve the large gas-engine, and, indirectly, by encouraging the use of coal gas as a domestic fuel and for the many industrial purposes for which it is eminently superior to other fuels—thereby providing a liberal supply of gas coke at a moderate price for use as a boiler fuel, either with or without preliminary gasification. Neither the direct gasification of bituminous coal nor its carbonization at low temperatures seems to have any prospect of competing with raw coal for boiler firing in large power stations. There is always the risk that the coal consumed in smelting the iron and baking the fire-brick required in the construction of large producer and carbonizing plants may be really wasted, in ill-directed efforts to prevent by novel methods "waste" of fuel in various directions. It is important that fuel economists should realize that when raw coal—especially in the form of dust—is burnt in large modern furnaces, the saving which may theoretically be effected by the use of producer gas or the like is often small. Expensive plant for gasifying raw coal must be shown to be capable of giving an adequate return; otherwise the coal resources of the country will have been appreciably depleted in the construction of plant which is unremunerative. Economy of fuel does not lie that way.

The foregoing observations and arguments apply only to the grades of bituminous coal which form the bulk of the supplies of raw coal for domestic consumption and the production of power. Special grades of coal—some exceptionally rich in volatile matter, others overloaded with ash, and yet others which are physically too tender or too small for general use in their raw state—may, of course, be advantageously utilized by low-temperature carbonization, or in Mond or Kerpely producers, or in other appropriate manner. The decision as to the most suitable method of utilizing such special grades of coal, of which large supplies are available, must rest with the fuel expert, and will depend not merely on the special nature of the particular coal, but also on local market and transport conditions. For dealing with such special cases, there are ample opportunities for the development of special gasifying and carbonizing (low temperature and otherwise) processes; and it would be well, in the interests of fuel economy, that the application of these processes should be restricted to the cases for which they are peculiarly fitted. Misguided attempts to apply them broadcast to the general run of household and boiler coal do the processes themselves the worst possible service, and they are greatly to be deprecated.

A final word on a cognate issue. The industrial development, and future prosperity of Britain when the present war comes to an end, will depend fundamentally on power, heat, and light being obtainable at the lowest possible charges. Native coal is the only generally available source of either; and it is imperative, therefore, that it should be won and transported at the lowest possible cost consistent with due conservation of the supply for later generations. Consequently, only the most economical machinery, labour, and administration must be made use of in the winning and transport of our coal; and any plant, man, or method which does not approximate to giving the best possible return in these public services must be ruthlessly "scrapped" in the vital interests of the community at large. State intervention and compulsion should be forthcoming if the end in view cannot be attained without them.

Sulphate of Ammonia Fertilizing Experiments.

A pamphlet has been issued by the Department of Agriculture of the Leeds University containing suggestions with special reference to the use of sulphate of ammonia in the manuring of various farm crops. It is pointed out that as the usual supplies of nitrate of soda will not be available this year, farmers will have to rely mainly on sulphate of ammonia for an active nitrogenous manure. Experiments have been conducted in the East and West Ridings of York on land varying in character. In the case of the barley crop, it is pointed out that by a moderate application of sulphate the yield of grain has been increased from 3¾ bushels per acre up to 7½ bushels. These results were obtained from experiments on different classes of soil, and under the varying climatic conditions of different years. The yield of oats at the experimental farm at Garforth was increased by 9½ bushels of grain and 4½ cwt. of straw per acre. For potatoes, sulphate of ammonia has been in great favour. Combined with farmyard manure and a mixture of artificial manures containing superphosphate and sulphate of potash, an application of 1 per cent. has increased the crop by 15¾ cwt. per acre. This is the average result of 29 trials conducted over a period of six years. As the result of 44 trials in eight seasons, it was found that an application of ½ cwt. of sulphate of ammonia, in addition to dung and superphosphate, increased the yield of swedes by 12 cwt. An application of 130 lbs. of sulphate gave, in the case of meadow hay, an average increase in four years of 6¾ cwt. per acre.

THE CARBONIZATION OF PITCH.

[Communicated.]

THE discussions which have appeared in the Technical Press of late on the above subject indicate that there are two quite distinct aspects of the problem. The carbonization of pitch may be looked upon purely as a commercial problem, in which case it is entirely a matter of pounds, shillings, and pence. From the other point of view, the idea is that, by the use of pitch in carbonizing plants, the continuous increase in stocks will be arrested, and the tendency will be to keep the price of tar from falling any lower than it is at present. The latter is supposed by some to be put forward as a patriotic proposition; but, after all, this at bottom has a touch of commercialism.

THE COMMERCIAL ASPECT.

Let us consider the proposal firstly from the commercial standpoint, as indicated above. In the carbonization of ordinary pitch the yield of coke may be taken as 60 per cent., of various oils 20 to 25 per cent., and of permanent gas 15 to 20 per cent. At present, pitch of this quality can be bought at about 15s. per ton delivered. No doubt if there was any considerable demand for it, the price would soon begin to go up; but for the purpose of the present argument, 15s. is a fair basis to take. In the carbonization of 100 tons of pitch mixed in with coal (say) on a bye-product coke-oven plant, the cost would be 1500s. The coke produced (60 tons), taken at the existing maximum price of furnace coke (24s. per ton), would yield 1440s. The 20 per cent. of oil would be again recovered in the tar, giving, on this basis, a yield of 20 tons; and this might be taken at (say) 20s. a ton, giving a total value of 400s. Of ammonia and benzol recovered from the pitch, the quantities of these are probably so insignificant as to be negligible. We do know that traces of ammonia are sometimes found in the distillation of pitch; but with a good hard pitch, such as would be used for carbonizing purposes, the amount, as stated above, would be negligible. With regard to benzol or light oils in general, we could not expect much of these to be formed. There is, of course, the possibility of some reactions taking place which would result in the formation of hydrocarbons of the benzene series; but, judging from analogous cases, we should hardly expect this to happen. The value of the permanent gas produced from the pitch may be taken at approximately 6d. per ton of pitch or 50s. in all. The cost of dealing with the pitch may be taken as being about the same as that of dealing with ordinary coal—say, 2s. 6d. per ton of coke, or 150s. We now get at the following balance-sheet.

Costs:	
100 tons of pitch, at 15s.	£75 0
Labour, at 2s. 6d. per ton of coke	7 10
Total cost	£82 10
Revenue:	
60 tons of coke, at 24s.	£72 0
20 tons of tar, at 20s.	20 0
Gas, at 6d. per ton of pitch	2 10
Total revenue	£94 10
Total cost	82 10
Profit on 100 tons of pitch	£12 0

No allowance is here made for depreciation, repairs, taxes, &c.

The above figures are, of course, only put forward as a hypothetical case, as, obviously, the yields depend on the quality of the pitch used, the price at which it can be bought, and the prices at which the products can be sold. There are no doubt cases in which a much more favourable balance-sheet can be brought out, as many writers have asserted that they would be glad to get even 10s. or 12s. per ton for their pitch.

THE TECHNICAL ASPECT.

Many objections have been put forward against the carbonization of pitch in bye-product coke-ovens; but the writer is quite convinced that none of those he has yet met with are insuperable. As already stated, it must be hard pitch which is used, as this contains less volatile matter, is more easily broken up, and is generally easier to deal with. In most cases with which the writer has met, two principal causes have accounted for the lack of success in dealing with this matter—viz.: (1) Insufficient mixing of the pitch with the coal before charging; and (2) attempts to use too much pitch with the coal. If we take as an average a yield of 3 per cent. of pitch on the coal carbonized—bearing in mind that a proportion of pitch is again recovered as such in the tar—we get the idea as to what quantity is available. A maximum admixture of 5 per cent. is, in the writer's opinion, the best to work with, as at this figure most of the troubles usually met with are eliminated. On a fifty-oven plant, carbonizing (say) 300 tons of coal, this proportion would necessitate the addition of 15 tons of pitch per day—a quantity which can easily be dealt with. The pitch should be roughly crushed, then mixed with the coal before passing to the disintegrators. This procedure ensures the thorough pulverizing of the pitch, and also results in the most intimate mixing possible.

The argument in favour of the use of pitch is sometimes put forward that the quality of the coke is improved thereby. In the writer's opinion, although this is undoubtedly true, it is not really worth the consideration of coke-oven people. To make any substantial improvement a very considerable quantity would be required, and the difficulties involved in its use far outweigh the advantages. With only 5 per cent., no fear of the mixture "running out of the doors of the oven"—as a speaker recently put it—need be experienced, neither are the smoke and flame produced in charging the ovens excessive. If an undue proportion of pitch is used, it must be remembered that some of this finds its way into the resulting tar; and the latter becomes more of a pitchy nature itself, and is thereby both more difficult to handle and also less valuable than the normal product.

Some very definite experimental work is required on the whole subject; and anyone who is able to carry it out will render great service to the industry. In matters of this kind, Government assistance and direction ought certainly to be forthcoming.

SIXTY YEARS AGO.

From the "Journal" for March 18, 1856.

Threatened Trade Inquisition.—Truly we live in times when constituted authorities appear to fancy themselves bound to right the wrongs of everybody, and to surround the exercise of the ordinary avocations of life with so many precautions that it is almost impossible to live. The numerous class of small shopkeepers and tradesmen are now being made to feel the effects of the Socialist doctrines they themselves were so anxious to apply to the public companies and the large industrial establishments they fancied to be established at their expense; and the provisions of several Acts they assisted in passing are now in course of application to themselves, as though it had been intended to convince them that the infliction of a wrong of any kind invariably recoils on its authors. That most ridiculous and iniquitous measure, the Public Health Act, was obtained mainly by the support of the municipalities, who were set in motion by the desire for cheap water, cheap sewerage, and cheap gas. Under cover of the excitement thus created, a series of enactments were smuggled through the Legislature, the effect of which is simply to place the whole of the trading community, agricultural or municipal, at the mercy of a set of ignorant quacks, called Inspectors of the Central or of the Local Boards of Health.

Royal Visit to a Gas-Works.—A letter was received on Monday evening, March 10, announcing to the authorities of the Chartered Gas Company that on the following day His Royal Highness the Prince of Wales would visit the Westminster station of the Company, and inspect the process of manufacturing gas. Next day came, and with it, sure enough, a goodly and distinguished group of visitors, including His Royal Highness the Prince of Wales, Prince Alfred, Colonel Phipps, and Mr. Gibbs, the accomplished Tutor to the Princes. They were duly received by the Governor (Benjamin Hawes, Esq.), the Deputy-Governor, a majority of the Directors, the Secretary (Mr. Burls), and the Consulting Engineer of the Company (George Lowe, Esq.); while to the Superintendent of the station (F. J. Evans, Esq.) was confided the important task of conducting the distinguished party over the works, and explaining the various operations of the manufacture of gas. Suffice it to say, that everything was seen, inquired into, and comprehended by the Royal strangers—the retorts, condensers, and purifiers were all shown in full action; a small experimental apparatus, in which the process of making gas was exhibited on a minute scale, elicited much admiration; and the comparative values of the cannel and common gases made at these works were seized upon with an intelligence and avidity that seemed almost to imply a previous acquaintance with the details of photometry. The distinguished party remained more than an hour-and-a-half, and quitted the works evidently much gratified with their visit, the proof of which has since assumed a tangible form in the shape of a very flattering letter of thanks to Mr. F. J. Evans for his attention on the occasion. This is, we believe, the first visit of British Royalty to a gas-works in this country.

Informal Meeting of Scottish Gas Managers.—We are informed by Mr. J. W. Napier, of Alloa (the Convener) that the Informal Meeting of Scottish Gas Managers will take place in the Grand Hotel, Charing Cross, Glasgow, on Wednesday, April 5, at 1.30, when Mr. Alex. Mackay, of Motherwell, will deliver an address.

Formation of Coal.—In discussing the microscopic nature of coal before a recent meeting of the Society of Dyers and Colourists, Dr. Hickling stated that, after extensive examination, the general impression left was that coal consists mainly of unfilled vegetable tissue. The transparent, visibly homogeneous material that constitutes almost the whole of bituminous coal must originally have been in a liquid condition, and so forced its way through the membranous walls of the cells, completely filling them. The process would be one of ordinary diffusion through a semi-permeable membrane; the original liquid content of the cell having diffused out and been replaced by the coal substance. The cell-wall itself, doubtless, remained saturated with the substance, and, indeed, its own material seems in most cases to have been gradually dissolved in the general mass. It is considered that what actually did happen during the formation of coal was that by far the greater portion of the carboniferous vegetation which now remains as coal was reduced by decomposition (probably bacterial) to a liquid state; the liquid being then soaked-up by the still undecomposed residues of the vegetation.

MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.

The Annual General Meeting of the Association was held last Thursday, at the Grand Hotel, Birmingham. There was a good attendance of members.

At the beginning of the proceedings,

The HON. SECRETARY (Mr. W. G. S. Cranmer, of Willenhall) remarked that he had received an apology from the President (Mr. W. J. Rendell Baker) for his absence. He was unable to be present in consequence of the death of his wife's father, whose funeral he was attending. Under the circumstances, he (the Hon. Secretary) thought that their immediate Past-President—Mr. W. S. Morland, of Gloucester—should occupy the chair until the time came for the induction of the new President.

Mr. MORLAND, on taking the chair, remarked that he was very sorry to hear that the President was unable to be present.

CONFIRMATION OF MINUTES.

The HON. SECRETARY read the minutes of the last meeting; and they were confirmed.

APOLOGIES FOR NON-ATTENDANCE.

The HON. SECRETARY said he had received a number of letters apologizing for absence from the meeting. Among them was one from Mr. W. R. Cooper, who was very unwell, and unable to venture out during this weather. Another was from Mr. T. Brooke, the Superintendent of the Nechells works of the Birmingham Corporation. He had been away for some time suffering from gas poisoning.

ANNUAL REPORT AND ACCOUNTS.

The annual report of the Committee and the accounts were next presented. The former sketched the proceedings of the year, and then concluded as follows:

Special general meetings were held on April 15 and May 27, which were addressed by the late Mr. Edward Allen, who explained the "C" process for toluol recovery, and pointed out that it was the patriotic duty of every gas undertaking to adopt the process.

Technical classes for gas-fitters were held at Birmingham, West Bromwich, and Wolverhampton, with the following results:

Birmingham	Grade I.	Passed 12	Failed 0	—
	Grade II.	Passed 5	Failed 0	—
	Final	1st Class 9	2nd Class 5	Failed 1
West Bromwich	Grade I.	Passed 1	Failed 1	
	Grade II.	Passed 0	Failed 3	
	Final	Passed 2	Failed 0	
Wolverhampton—Grade I.		Passed 8	Failed 0	

Your Committee regret to report the deaths of Mr. W. Langford, of Longton, and Mr. Edward Allen, of Liverpool.

During the year four new members have been elected, two have died, and three have resigned; the membership now being 114.

The CHAIRMAN observed that it would be noticed from the report that the amount brought forward was £62 13s. 10d.; and this compared very favourably with previous years.

Mr. B. W. SMITH (Walsall) proposed, and Mr. J. S. CRANMER (Stratford-on-Avon) seconded, the adoption of the report and accounts.

This was agreed to.

REPORT OF THE COMMERCIAL SECTION.

The CHAIRMAN said the next item on the *agenda* was the report of the Commercial Section; and Mr. Bell would propose its adoption.

Mr. J. FERGUSON BELL (Derby) said it afforded him much pleasure to move the adoption of the report of the Commercial Section. The members would be glad to know that during the year the membership had increased to 44. They started the section with 36. They had held during the year three general meetings and six Committee meetings, at which various matters of a commercial character were discussed. The year 1915 had been a very strenuous one for all gas undertakings; and he ventured to say the Commercial Section had rendered great assistance to those undertakings and engineers who were associated with it. They had resolved to go a step forward. In the first place, they had decided to take a room at the Grand Hotel, Birmingham, on the first Thursday of each month for the holding of meetings, at which any question concerning their commercial interests could be informally discussed. Then their monthly statements had hitherto been confined chiefly to stocks and sales of coke. Now they had extended the list by including tar and liquor, oil from carburetted water gas, spent oxide, and other matters. Therefore, he thought the members would agree with him, the monthly statements would now be of greater advantage to the members on account of the additional information contained in them as to the prices of the various commodities in which they were interested. He formally moved the adoption of the report.

Mr. HUBERT POOLEY (Leicester) seconded the motion, which was unanimously agreed to.

NEW MEMBERS.

The HON. SECRETARY said the following gentlemen were recommended by the Committee for election: Mr. C. M. D. Belton, of Shrewsbury, Mr. L. J. Langford, of Stoke-on-Trent, and Mr. W. Orme, of Dronfield.

On the proposition of Mr. W. C. JONES (Brierley Hill), seconded by Mr. H. E. COPP (Etruria), the three gentlemen were unanimously elected members.

BENEVOLENT FUND OF THE INSTITUTION.

The HON. SECRETARY read the following communication which he had received from Mr. Walter T. Dunn, the Hon. Secretary of the Benevolent Fund of the Institution of Gas Engineers:

With reference to the deficit on last year's accounts, amounting to £52 19s. 8d., which has arisen in consequence of losses of subscriptions by death, and to the increased number of applications for assistance, it has been thought that possibly your Association might be disposed kindly to make a donation which would aid the Committee in continuing the existing grants, and in dealing with new applications which are likely to be made.

Last year the following donations were received from District Institutions:

Manchester District Institution	£10 10 0
North of England Association	10 10 0
Wales and Monmouthshire Institution	2 2 0

Would you be so good as to bring the suggestion under the consideration of your Committee.

I need scarcely add how greatly the Committee of Management will appreciate their help.

The CHAIRMAN observed that some years ago, in Mr. Meiklejohn's time, they had a "whip-round" in the Association, and got a good many members to subscribe to the Benevolent Fund; and they also made a contribution from the funds of the Association—he believed of 25 guineas. Since then their funds had been somewhat depleted. Besides subscribing to the Benevolent Fund, they also subscribed to the Livesey Memorial Fund; and these drafts drew their bank balance down rather low. Now they had a balance of £62 13s. 10d. If the members thought they might get rid of some of this by subscribing to the Benevolent Fund, now was the opportunity. Those members who did not subscribe to the fund should do so. There was no fixed amount; and any sum, even as low as 5s., would be gladly received.

Mr. J. FERGUSON BELL said, as an old member of the Benevolent Fund Committee, he was aware of the great good that was done. He wished to propose that a sum of 10 guineas be voted to the fund from the balance they had in hand. This was not an Association for the accumulation of money; and they could afford the amount he had named. This, however, would not absolve the members from making personal contributions.

Mr. SAMUEL GLOVER (St. Helens) seconded the motion; but he said he would have done so more heartily if Mr. Bell had put the contribution at 20 guineas. He suggested that the amount be increased to this sum.

Mr. B. W. SMITH (Walsall) supported Mr. Bell's motion.

The PRESIDENT-ELECT (Mr. C. H. Webb, of Stourbridge) pointed out that Mr. Dunn in his letter stated that the deficit on last year's account was £52 19s. 8d. If the Association contributed 10 guineas towards this, and the other Associations did the same, surely they would be doing their share. There might be a deficit another year, and then another invitation to contribute.

Mr. THOMAS BERRIDGE (Leamington) said there ought really to be no difficulty in getting the money to meet the deficit, and he supported Mr. Bell's proposition.

Mr. COPP remarked upon the fact that the Association's balance had been dwindling the last few years.

Mr. VINCENT HUGHES (Smethwick) thought the Midland Association did their share very nobly to the Benevolent Fund. Speaking broadly, about 80 per cent. of the members subscribed to the Benevolent Fund; and if members of other Associations did so in like proportion, then a whip-round would not be necessary.

Mr. GLOVER said, after the remarks that had been made, he would not press for the 20 guineas, but would support the vote for 10 guineas.

Mr. GEORGE HELPS (Nuneaton) also supported the 10 guineas. At the same time, he rather doubted if 80 per cent. of the members of the Association subscribed to the fund, though he would be very pleased if the statement were true. He was told that there were certain members of the Benevolent Fund Committee who were not subscribers to the fund. To which he replied, that if it were so, the members would soon become subscribers.

Mr. BERRIDGE, in reply to the President, said that he thought it was quite in order to appoint men who were non-subscribers on the Committee of Management, though he did not think it was actually the case that there were such men upon it. The reason that there was the possibility was that on the Committee there were seven members appointed by the subscribers, also the Hon. Secretaries of the Associations affiliated to the Institution, and three members (elected by the Council) from the Finance Committee of the Institution.

The motion was unanimously carried.

The New and the Late President.

The Chairman said he had now to ask their President for next year (Mr. C. H. Webb, of Stourbridge) to take the chair. He had no doubt that Mr. Webb would conduct the business of the Association in such a manner that it would redound to his credit, and to that of the Association. He handed to Mr. Webb the badge of the presidential office.

Mr. Webb on taking the chair was very heartily received.

The President said the first duty he had to perform was to propose a vote of thanks to their Past-President (Mr. Rendell Baker) for his services in the presidential chair during the past two years. Owing to the war, this period had been a difficult one for a President. Mr. Baker occupied the office for the second term really with the feeling that it would possibly be for the benefit of his successor. It was hoped that the war would have been over in the year just expired, and that the President who would follow Mr. Baker would have a clear course and an easier time through the nation being at peace. The hope had not been realized; but he (the President) trusted that peace would be restored during his year of office.

Mr. Morland seconded the motion, remarking that there was no doubt Mr. Baker had had two very difficult presidential years.

The proposition was carried.

District Representative on the Institution Council.

Mr. Copp moved that the President be elected district representative on the Council of the Institution of Gas Engineers. This was a position to which a great deal of honour attached; and he was perfectly certain the President would fill it not only with credit to himself, but also to the satisfaction of the members.

Mr. W. H. Johns (West Bromwich) seconded the motion, which was agreed to.

The President thanked the members for the expression of their confidence. He assured them that he would do his best to serve the interests of the Association.

Reports of District Associations.

On the proposition of Mr. S. Glover, seconded by Mr. Bell, it was decided that the annual volume of "Transactions of the District Associations" should be forwarded to the members.

A Vote of Sympathy.

Mr. W. C. Jones (Brierley Hill) remarked that one of the members, Mr. G. A. Collins, of Dudley, was seriously ill; and he (Mr. Jones) thought that an expression of the sympathy of the members going to him on his bed of sickness would be much appreciated by him.

Mr. Berridge, in seconding, said Mr. Collins was a very old member of the Association, and a regular attendant at the meetings. Though he did not speak much, he was ever ready to give of his experience. They hoped he would soon get better, and be among them again.

The President said, as a neighbour, Mr. Collins had frequently been up to have a look at his works, and he had been to Mr. Collins's, and they often had a talk over affairs in which, as gas men, they were mutually interested. They all felt very sorry for him in his affliction; and he supported Mr. Jones's suggestion.

The proposal was unanimously agreed to.

The President then delivered the following

INAUGURAL ADDRESS.

Gentlemen,—Allow me to thank you for the honour you have conferred upon me by electing me your President. It will be a great pleasure to preside over your meetings in the ensuing year, as I feel sure I can count on the loyal and cordial support of every member in carrying out the duties of the position. Needless to say, nothing shall be left undone which lies in my power to further the interests and aims of the Association.

We deplore the loss of two members during the past year—Mr. Edward Allen and Mr. William Langford. Both these gentlemen were of a type we can ill-afford to lose, and the case of Mr. Allen was particularly sad, as there is no doubt his death was due to the very heavy work he had undertaken in the service of the Nation.

According to our rules, the object for which the Association is established is to promote the advancement of the gas industry in all or any of its branches. One of the rules states that meetings of the Association shall be held in February, May, and October of each year. As one who has the interests of the Association at heart, I do not see that the object for which it was formed can be fully carried out when only such a small number of meetings are held, especially seeing that usually one of these meetings is a visit to some works, when no technical business is transacted. This means that on only two occasions per annum do we discuss matters relating to our industry. In a profession whose branches are so many and varied, there must be far more subjects to be investigated and discussed than can be undertaken at only two meetings. I am in favour of a greater number of meetings, and of a different way of dealing with our subject-matter. I believe that short communications, or collections of notes, would be more effective than the lengthy papers usually provided, in producing interesting and useful discussions. The preparation of a long paper is a matter involving great expenditure of time and labour; and as (referring to the rules again) the greater number of our members are engineers or managers of gas undertakings, or superintendents of gas-works making 500 millions or more per annum, the onerous nature of our duties prevents us from giving up the time required in preparation. A short collection of notes does not involve so much labour, and yet can be made to cover the ground sufficiently to induce the desired discussion. I further think that the man who should best be able to undertake the preparation of a long and detailed paper on the working of any particular portion of our various processes, is the member of the Junior Gas Association who, as a technical assistant or superintendent at a medium-sized gas-works, can, with the permission of his chief, devote a great deal of time continuously to observe the working of any process, and to collect the necessary statistics relating to it. Our time and experience are better used, to my mind, in considering the results and statistics thus accumulated by our assistants, in their relation to, and general bearing upon, the running and economy of the undertakings we control.

In the course of my remarks, I shall mention several subjects on which information would be useful to the members of the Association; and I trust that those who are in a position to assist will come forward during the year, and give us the benefit of their experience.

The War.

This is the subject that is naturally uppermost in our minds at the moment. The effect upon our industry is felt in every direction. Prices of raw materials have naturally advanced—coal, gas oil, &c., being much dearer than formerly, owing to the difficulties caused by shortage of labour, increased wages, and transport problems. In fact, at the present time, the quotations for gas oil are almost prohibitive. In the case of coal, the Price of Coal (Limitation) Act has had, I think, a very good effect, though when it was passed many of us were inclined to doubt its value.

Assuming sufficient coal to have been bought, many engineers have still found great difficulty in getting it from the collieries to their works; and the past twelve months have shown, more than any other period, the great advantages obtained by the ownership of waggons. Those undertakings which have had to depend on colliery and railway companies' waggons have, in a number of cases, fared very badly during the past winter. At Stourbridge, we are fortunate in having a sufficient number of waggons of our own to bring in the whole of the coal required during the summer months, leaving only the extra quantity above that necessary in the winter to be carried by other waggons.

I am glad to see that the proposal recently brought forward as to the "pooling" of waggons, has apparently been dropped, as this would have been penalizing those undertakings which had provided themselves with waggons, in favour of those who had not. There would have been no objection to the pooling had it been necessary for Government purposes.

The war has also caused us great anxiety in the direction of our residuals, and has brought a new one—viz., toluol, if it can be called a residual—prominently to our notice. I am glad that we are to be favoured to-day with further information on this subject from gentlemen who have been prominent in investigating the various methods of increasing the output of this substance. The difficulties of handling our tar have been very great, chiefly on account of the pitch problem; and more recently sulphate of ammonia has given us serious cause for thought, owing to the cost and short supply of acid. We are informed that the Government requirements of acid are becoming still greater, and we are asked to experiment with a substitute in the form of nitre cake or nitre cake solution. Information as to results obtained on the use of this material from those members who have tried or are trying it will, I am sure, be much appreciated by the Association. Coke has given us trouble in another way; and that is, in trying to satisfy those users of it who have wanted more than we have been able to supply.

Most of us have been worried by the necessity for increased charges for gas, increased income-tax, adjustments of public lighting agreements, &c.; and only a few days ago, as a last straw, I found myself called upon to supply certain information to the Surveyor of Taxes as to excess profits. Still, I imagine that, with true British spirit, we shall overcome all these difficulties as they arise, and, in so doing, feel that we are contributing our part to the attainment of the objects which the Nation has in view.

Works Topics.

As a very satisfied user of horizontal retorts, carbonizing heavy charges of twelve hours' duration, with good stoking machinery and telpher equipment, I have yet to be convinced that vertical retorts are superior, except, of course, in economy of space.

We are all familiar with cost of repairs, scurfing, fuel consumption, &c., of horizontal retorts; but many of us would like more data on these and other subjects as applied to vertical retorts. Perhaps at a future meeting some members who have vertical retorts under their control will give us some notes upon these points.

A method of scurfing retorts has been adopted at Stourbridge, which I believe is not generally used. No carbon is recovered, but, on the other hand, no labour is required; and it will be generally admitted that the labour expended and the damage done to retorts by bar-scurfing have far more than balanced the value of the carbon obtained. It is our practice when running six beds of eight, or 48 through retorts, to lay-off at least one retort per day for the whole of the 24 hours. Our retorts have two ascension pipes; and when it is desired to scurf a retort the cap is taken off the south end ascension-pipe, and a fire started in it, which creates

an up-draught. The south end lid is then closed, and the north end lid opened; thus a current of air is drawn through the retort. When the south end ascension-pipe is burned clear, the process is reversed—*i.e.*, the north end cap is taken off, and the north end door closed, and the south end door opened. By this means, every ascension-pipe is burned quite clear, and every retort is scurfed in rotation in about six weeks.

We have only a small overhead hopper to feed our stoking machine, the capacity of which is about 30 tons, or half-a-day's supply. Overhead sidings run into both sides of the retort-house, from which coal is dropped from the railway waggons into bins, about 12 feet deep, over the hoppers of the coal-breakers. The bins hold about 150 tons each, and duplicate elevators and breakers feed from the bins into the overhead hopper. It was anticipated when the plant was installed that trouble would be experienced by the coal, when stored to a depth of 12 feet in the bins, jamming, and not feeding properly to the breakers. This is not the case usually, and only occurs with exceptionally large coal. The hoppers of the breakers are fitted with swing doors, operated by gearing. The elevator attendant stands on a platform half-way up the elevator, and, by a hand wheel, regulates the swing door below, so that the elevator buckets are always just full. The elevating operation, therefore, takes the minimum of time. Thus, although the overhead hopper is so small, we have a stock of 200 to 300 tons of coal available for the charging machine without the labour of wheeling. Our elevators and breakers being in duplicate, there is not much risk of complete failure.

Repairs to purifiers and their valves generally necessitate a stoppage of gas manufacture, which may not be convenient at the time when the repairs are required. We have at Stourbridge a carburetted water-gas plant with a large relief holder, into which the crude gas is led, and thence to the exhauster, where it mixes with coal gas. A valved connection has been made between the works' main at the inlet of the purifiers and the carburetted water-gas main on the way to the relief holder. Then if the relief holder is empty, and the carburetted water-gas plant shut-down, the purifiers can be closed-off, and coal gas sent into the relief holder for a number of hours, while the repairs to the purifiers, or their valves, are being effected. Then the purifiers are put on again, and the gas drawn from the relief holder and sent through them.

CARBURETTED WATER GAS OR OIL GAS.

Although at the present time, when gas oil is so dear, owing to the cost of transport, that very valuable portion of the producing plant, the carburetted water gas or oil gas apparatus (as I prefer to call it), is being used as little as possible, yet no doubt the use will be considerably extended when oil prices approach nearer to the normal. I have noted a few points which are perhaps worth mentioning.

Great care should be taken to see that the generator steam spray is delivering steam centrally. If delivery is irregular, the generator brickwork will wear unequally, and relining will be required sooner. Meanwhile, the results will fall off, due to the fuel bed receiving too much steam on one side, and not enough on the other. After correcting the delivery of the spray in our plant recently, a permanent increase of nearly 5 per cent., or over 1000 cubic feet per hour, in the gas made, was gained.

It is advisable, if the oil is delivered to the carburettor by steam cylinder, to fit a reducing-valve on the steam supply. By this means, steam is delivered at full volume at the beginning of the run, and at a constant pressure throughout the run. Without such a regulator, the condensation of the steam is only gradually overcome, and the least quantity of oil is delivered at the beginning of the run (when the chequers are hottest), and the greatest quantity of oil at the end of the run (when the chequers are coolest).

As previously stated, the oil gas is mixed with the coal gas at the inlet of the exhauster. The mixed gases are purified jointly, and measured together by the station meter. The oil gas is admitted to the exhauster at a steady rate throughout the 24 hours, and this rate is ascertained by a diagrammatic meter of the type used on the town mains to show the delivery of the gas, and to indicate breakages of mains. This meter (which is quite a small piece of apparatus) is fixed in the engine room, and the attendant, by regulating on the inlet valve, can ensure a constant rate of mixture of the two gases, which is most beneficial. The meter only requires a new chart daily, and, when in regular use measuring the crude gas, cleaning weekly, which operation only takes an hour or less. If this is done, no fault can be found with its accuracy; and in any case, an error is only between the coal gas make and the oil gas make—the total gas made being measured after purification by the ordinary station wet meter.

Whenever unsatisfactory results have been obtained by the use of oil gas, it will be found, I think, to be due to one of the following causes.

If the oil-gas plant is only used for a portion of the day, and the relief holder is too small for the size of plant installed, this necessitates the gas being rushed through to the purifiers as made, and the oil gas, instead of being mixed regularly with the coal gas, is delivered in varying proportions.

If the illuminating power standard is adhered to, and the two gases are made of about the same illuminating power, the combined calorific value is less than that of coal gas alone, which gives trouble with many pieces of gas apparatus in the district.

If, however, the two gases are made of about equal calorific value, then no trouble will ensue, even if the percentages of oil gas in the mixture vary considerably from time to time. This method of giving the full calorific value costs the gas undertaking a little more than if the illuminating power standard alone is worked to, but the extra cost is counterbalanced by the satisfaction of the consumers.

BRITISH AND GERMAN GOODS.

It has been surprising to note during the past year the number of articles required for gas-works purposes which have been, found to be of German manufacture. In a number of instances. we have been informed by the sellers that their stock of some article has been depleted, and that it will not be possible to supply for some time to come; and the country of origin has only been disclosed after further inquiry. On the other hand, it is good to note that when the article has been one in regular demand, and in some quantity, the manufacture of an English substitute has quickly commenced; and, further, that this has often been a considerably better article. It may be said that the cost of the substitute is sometimes more than was previously the case with the original article. But it must be remembered that war conditions are largely responsible for this; and it is to be hoped that, when trade returns to the normal, the price of the English article will drop sufficiently to be able to compete with the foreign one This should be so, I think, if the English manufacturer is properly supported by us as buyers.

I consider English manufacturers would do better if there was more standardization, and a less number of different sizes made in some classes of goods. Taking the case of wrought-iron tubing, surely if 1½-inch tubing is found to be too small for a particular job, then the 2-inch size would not be much too large, and could be used without having the intermediate size—1¾-inch diameter. This would reduce the number of sizes to be stocked by both manufacturer and user, and would result in considerable economy to both. Similarly, in the case of cast-iron mains. At Stourbridge, we only use 4-inch, 6-inch, 8-inch, 12-inch, and 16-inch diameters, each of these sizes being approximately double of the one below.

AN AIR RAID AND THE GAS SUPPLY.

The only time on which I have ever entirely cut off the supply of gas to the town occurred on the occasion of one of the recent Zeppelin raids. The Zeppelin passed over the Midlands, and, on receiving warning of the raid by telephone, the Superintendent of Police considered it advisable to have the gas turned off—the town being lighted by nearly 500 lamps, which is rather more than half the total. The supply was renewed at about 8 o'clock the following morning, and no mishap of any kind occurred. As many factories as possible were notified by telephone; and men were sent by motor car in various directions in the district to notify the residents and to turn off the lamps. Since then, the Lighting Order has come into force, and the public lighting has been reduced to a very small amount, and the lamps carefully shaded; so that in the case of another raid, we shall not be called upon to take such a drastic and somewhat dangerous method of dealing with the matter.

OUTDOOR DEPARTMENT.

After experience of almost two years' duration of the advantages of a show-room in the centre of the town, I am thoroughly convinced that no gas undertaking of any size above the smallest can afford to do without one. It should, of course, be arranged that gas accounts may be paid there, as this ensures a steady stream of visitors, who are already users of gas, and who thus have all new apparatus brought to their notice periodically. If sufficient accommodation can be obtained, the outdoor superintendent should have his office in the same building, so that he can be called into the show-room for consultation when necessary. It will generally be found convenient to have the outdoor department stores situated there, and to make it the headquarters for the town fitters and for lamplighters.

Our high-pressure main for shop lighting was completed in October, 1914; and though orders for lamps were few, owing to war time economies, and though the plant has been shut-down entirely since the lighting restrictions came into force, it worked very satisfactorily both in regard to lamps and compressors. The high-pressure main is a steel one, with welded joints. I feel sure that, after the war, considerable profitable business will accrue from this branch.

We dispose of any kind of gas apparatus whatever on hire-purchase terms. The period is usually three years, and a simple form of agreement is issued. One of the most successful branches has been the hire purchase of gas-engines (ours is an industrial district), and sizes up to 50 B.H.P. have been put out. No trouble has been experienced as to payment, and it is found that a 50 B.H.P. gas-engine, working shop hours, means a sale of from 800,000 to 1,000,000 cubic feet annually. If the hire-purchase system had not been adopted, an electric motor would probably have been hired by the consumer, or we should have lost the sale of nearly 1,000,000 cubic feet per annum for three years, assuming that the consumer waited this length of time to accumulate spare capital to purchase the engine for cash. I consider the system is very necessary in a district where electrical competition is keen.

We have had a motor delivery van in use for over two years. Although it was originally a four-seater car, and, on our purchase, had a van body adapted to the chassis, it has done very good work in the delivery of cookers, meters, and in assisting the pre-payment meter collectors, and has saved a good deal more than its cost in inspectors' and fitters' time. I am now considering the

advisability of recommending my Board to make a further purchase, and think that at a future meeting of the Association it would be very helpful if those members who are using motor vehicles for gas-works purposes would describe the types they have in use, and give the Association some points in the selection of suitable kinds of motor vehicles for gas-works traffic.

BRITISH COMMERCIAL GAS ASSOCIATION.

Splendid work is being done by the Association—results being obtained which, in my mind, could not be approached by any system of individual and local effort. I have had many proofs of the success of the "Advertising Scheme" which is carried out by the Association, and would urge that all gas undertakings should become subscribers, so that the maximum amount of financial and other support shall be given to the movement. As all undertakings must benefit directly or indirectly by the work done, so all should bear their proportion of the expense. The difficulties as to municipal undertakings becoming subscribers have lately been removed. I would refer you to the very interesting March number of the "Bulletin" of the Association, where the "difference that advertising makes" is exceedingly well told.

SULPHATE OF AMMONIA ASSOCIATION.

The same remarks to a great extent also apply to the work of the Sulphate of Ammonia Association, in respect to their propaganda branch, and all undertakings making sulphate of ammonia should not hesitate to contribute their quota to this branch. I must admit I am not yet fully converted to the idea of the selling branch. This may perhaps be because Stourbridge is close to an agricultural district, and no great difficulty is experienced in disposing to local users of a considerable portion of our output of sulphate of ammonia.

CONCLUSION.

In conclusion, I would say that I have had very little spare time during the past few months to devote to the preparation of this address, and can only trust that, embodying as it does some points of my own ideas and experience, it may not be without interest to members of the Association.

THANKS TO THE PRESIDENT.

Mr. MORLAND proposed a hearty vote of thanks to the President for his address, the contents of which, he said, would assist them very much in working their own undertakings. Mr. Webb had given them many ideas which they would probably be able to apply in their own works. The address was to the point; and the information in it was excellent.

Mr. FLETCHER W. STEVENSON (Coventry) said he had had the pleasure of knowing the President for several years, and had had the added pleasure of visiting his works. He was very much struck when there by the many little things that Mr. Webb had that some gas engineers had not, and, indeed, which they had not thought of. No doubt they were useful to him, and would be to others in regulating their works. The President had given them so much information about these things, that there was the danger that he would be flooded with members going to see him, and so have too many visitors. Those who did not know his works would find that they could not go to them without learning a very great deal. They must all feel the address he had given them was an excellent one. It also had the merit (which the President had taken as a demerit) of not being too long. It had held the interest of the members the whole time; and from what he had said in it, they knew they had a President who would be in touch with the Association throughout the year, and would be a help to them all. He wished him every success in his office as President, and had much pleasure in seconding the motion.

The proposition was heartily passed.

The PRESIDENT thanked the members for the reception of the address. The only point he would refer to was as to what Mr. Stevenson had said about visitors. There were never too many visitors to Stourbridge. He was always glad to see brother engineers on any excuse whatever.

BENZOL AND TOLUOL EXTRACTION BY AMERICAN GAS OIL AND GREEN OIL.

Mr. JOHN BOND (Southport) and Mr. HUBERT POOLEY (Leicester) then opened a discussion on the above subject—Mr. Bond giving his experiences as to the extraction of benzol and toluol with American gas oil, and Mr. Pooley with green oil. A report of the discussion commences on p. 689.

TOLUOL AND THE LIMESTONE PROCESS.

Mr. GEO. STEVENSON prepared a paper for the proceedings on "Toluol and the Limestone Process." It is published on pp. 692-94; but the discussion is deferred under the following circumstances.

MAY MEETING TO BE DEVOTED TO DISCUSSION.

At the close of the discussion on the extraction of benzol and toluol by oils,

Mr. J. FERGUSON BELL said that the hour was getting late; and he suggested that Mr. Stevenson's paper should be deferred to the next meeting. In the meantime, the members could read the paper; and, as the process was one in which a great deal of interest had been taken, he was certain the delay would result in a better discussion.

Mr. BERRIDGE, in seconding the proposal, agreed that the members would be in a better position to discuss the paper later on.

Mr. VINCENT HUGHES supported the suggestion.

The PRESIDENT remarked that, as time was going on, and Mr. Stevenson had gone to a tremendous amount of trouble over the paper—largely at his (the President's) request—it seemed to him that it would be better for the paper to be printed and then fully discussed later. As to the meeting, he was going to mention the point. It was not his (the President's) intention to ask the members to visit Stourbridge for the May meeting, because he hoped to do so at a subsequent date. His Committee would like the opportunity of welcoming the members to the town. But they did not feel that the present time, while the war was on, was the best for doing so. When the members went to Stourbridge, they wanted to entertain them well, and show them some of the surrounding country. But at present most gas engineers were very busy; he was himself. And so he was hoping to be able to extend to the members an invitation to Stourbridge after the war was over. It was, however, his intention to ask the members if they would like to hold an ordinary meeting in May. If they did this—say, on the third Thursday in May—Mr. Stevenson's paper would give them suitable subject-matter, and they would have fair time, for discussion. If this met with the approval of the members, he should like to have a May meeting.

Mr. BERRIDGE proposed that the suggestion of the President be adopted.

Mr. BELL seconded, remarking that now was not the time for banquets or anything of that sort. But he did hope the President would be able to invite the members to Stourbridge when the war had been brought to a satisfactory conclusion.

The proposal was adopted; and this ended the business proceedings.

At the invitation of the President, the members afterwards had tea together.

COKE-OVEN MANAGERS' ASSOCIATION.

Lecture by Professor Cobb.

A meeting of the Coke-Oven Managers' Association was held at the Leeds University last Saturday afternoon, especially for the purpose of hearing a lecture on "Refractory Materials and Salty Coals" by Professor J. W. COBB, Head of the Department of Metallurgy at the University. The PRESIDENT (Mr. George Chrisp) occupied the chair. The attendance was the largest on record in the Association.

The PRESIDENT, at the outset, said that in obtaining the services of Professor Cobb to give the lecture the Association might be heartily congratulated, because, in view of the troubles of to-day, the systematic examination of the problems connected with the carbonization of coal was a very important matter; and anything the Association might do towards solving these problems would be of great good. Professor Cobb was very conversant with the subject, and was about the first man in the country in regard to refractory materials. He had a very interesting array of samples. The problem of salty coal was a vexed one. There were many opinions as to what effect heavy salt had, and they would be able to hear some opinions on this matter. Some of them held views that if the benzol production went down, they could blame the salt in the coal; and they blamed the salt for other things. In the old days, if anything ever went wrong it was usual to blame the washer. Nowadays they were more scientific, and blamed the salt.

Professor COBB, who was warmly received, then delivered his lecture, illustrated by displayed specimens and lantern slides recording experimental results, on

REFRACTORY MATERIALS AND SALTY COALS.

When men responsible for the technical direction of an industry are once convinced that under the detail of their work lies a substratum of principles which can be unearthed, and a wealth of experience which can be pooled, to mutual advantage, and when it is realized that progress can be secured most effectively by the co-operation implied, that industry enters on a new stage of development. Some such idea, I believe, inspired the formation of the Coke-Oven Managers' Association; and as the head of a department which is very specially concerned with fuel, in a University which has for many years past recognized, or even anticipated, the claims of industries to the best of its services, I welcome warmly the Association and its members.

It is hardly necessary to say to you that at this time we cannot be expected to remember with anything but regret the extent to which the higher technical direction of the coke-oven industry has been imported. There is only one certain remedy; and it is to make the best possible use of every man now in the industry (which necessitates that every man should make the best of himself), and to train up a corps upon which to draw, thoroughly equipped for the work, who can attack with skill and confidence the numerous and complicated problems that are inseparable from rational carbonization.

I propose to say something about one problem to-day; and as to its importance there will, I venture to state, be no two opinions in your minds. A very important item in the running costs of a bye-product coking plant is that of repairs and renewal of oven-walls; and before the reason was grasped, costly miscalculations were made under this head, when the coal to be carbonized

happened to contain common salt (NaCl). The walls wasted rapidly, and required frequent renewal; and the wasting was not from high temperature, occurring as it did on the inner faces of the oven-walls, where the temperature was lowest. The evil continues; and although information has been acquired by costly experience, and we now know something more about it, nothing, so far as my knowledge goes, has been forthcoming which can be regarded as offering any adequate answer to the question raised. The difficulty is emphasized in the coals from certain districts. South Yorkshire, North Derbyshire, Staffordshire (Stoke district) are notorious. Wales, on the other hand, is favoured. There has not been sufficient systematic geological work done to afford an explanation of these regional peculiarities. Some observations of my own may throw light on certain aspects of the problem as it affects carbonization industries through the refractory materials used in their plants. That is all I claim, or hope.

Some Experiments on Coals.

In these days, when the washing of coal before coking has become so very general, it would appear at first sight that the soluble common salt would be washed out as a preliminary. But this is not so. The admixture of the salt with the coal substance is apparently very intimate, and coal is not porous in any ordinary sense. Even when the coal is finely divided, extraction by water is very imperfect.

The following experiment was made on coals which were ground, put through a sieve 12 meshes to the inch, and then over one of 50 meshes to the inch to remove dust. The salts were extracted with hot water, and afterwards with 10 per cent. nitric acid. The results are recorded below.

Chlorine Extracted as Chloride from 100 *Grammes of Coal.*

—	Water Extraction.	Acid Extractions.					Total Extraction.
		1.	2.	3.	4.	5.	
Coal 1.	·38 4 hrs.	·22 18 hrs.	·116 6 hrs.	·054 29 hrs.	·024 40 hrs.	traces 2 days	·794
Coal 2.	Slgt. Tr. 22 hrs.	Slgt. Tr. 23 hrs.	—	—	—	—	Trace
Coal 3.	·36 4 hrs.	·148 18 hrs.	·068 6 hrs.	·028 29 hrs.	·014 40 hrs.	traces 2 days	·618

The slowness of extraction, and particularly the incompleteness of the first extraction, even when the coal was finely divided, and the time of contact extended over hours, are significant.

Analyses of Salts.

An analysis of the soluble salts extracted by water from finely-divided coal is of interest. Two such analyses are given below:

Weights Extracted from 100 *Grammes.*

—	SO_4.	Cl.	Ca.	Mg.	Na(K).	Total.
Coal A	·0064	·121	·014	·0034	·165	·3098
Coal B	·0125	·352	·0514	·013	·161	·5899

It is evident that in these cases sodium chloride was the dominant soluble constituent; and since soda would not be volatilized from any such insoluble salt as a soda felspar during carbonization, it is permissible to restrict the consideration of the influences arising from the volatilization of sodium salts to this constituent. Salt goes, then, into the oven with the coal, and experience shows that, if the charged coal contains more than a small quantity (say, 0·05 per cent.) of NaCl, the oven-walls suffer, though a rather larger amount does very little damage if the temperature of coking is low. When the temperature of the oven rises, the salt begins to volatilize.

At 800° C., sodium chloride melts; but it volatilizes in some quantity at lower temperatures. A recent laboratory experiment showed that at 800° C. the volatilization occurred at a rate of 6·9 per cent. per hour, or with relation to the surface of sodium chloride exposed at a rate of 0·17 gramme per square inch per hour, or nearly 1 oz. per square foot. Analysis of the residue showed it to consist of sodium and chlorine in the ratio proper to NaCl; so that volatilization had occurred in the same ratio. It was a pure volatilization of salt as such, neglecting dissociation which would be negligible at this temperature. Calcium chloride, on the other hand, heated under the same conditions, did not volatilize. It lost chlorine, but no calcium. A mixture of lime and sodium chloride simply lost sodium chloride—*i.e.*, sodium equivalent to chlorine—at a rate roughly the same as with sodium chloride alone.

The table appearing below indicates the analytical results on which these conclusions are based. The figures can only be taken as approximations; but their indications are probably useful. Apart from their bearing on the volatilization of salt, the results with the lime-salt mixture would oppose the idea sometimes expressed that the addition of lime fixes to an appreciable extent the chlorine of any sodium chloride present, and so lessens the ammonium chloride vapour in the coke-oven gas. In this respect they agree with my own experience in a matter which is one of great importance, though not the primary object of this lecture.

Losses on Heating for Two Hours at 800° *C.*

Material Used.	Weight of Material.	Loss of Weight in Gms.	Analysis of Residue After Heating.			Per Cent. Loss on Heating on Original Weight.
			Gms. Na.	Gms. Ca.	Gms. Cl_2.	
Sodium Chloride . NaCl . .	2·5 gms.	0·346	0·83 equivalent to 1·28 gms. Cl.		1·27	13·82
Calcium Chloride . $CaCl_2$ . .	3·30 gms containing 2·11 gms. Cl_2.	0·191		1·19 equivalent to 3·31 $CaCl_2$.	1·62	
CaO + NaCl . .	1·25 gms. 1·25 gms.	0·142	0·42 equivalent to 0·65 Cl.	0·89 equivalent to 1·25 CaO.	0·64	5·8*

* 11·6 per cent. of the NaCl.

Volatilized Salt and Fire-Clay Walls.

I wish to deal with the interaction that occurs between the volatilized salt and the fire-clay walls of the oven, which we know to have such disastrous consequences. The ground may be cleared to some extent by getting rid of the assumption that the action—even repeated action—of sodium chloride on the surface of fire-clay has necessarily any very detrimental effect. In the manufacture of what are known as salt-glazed bricks, the walls and arches in the kilns are subjected repeatedly, over many years, to an atmosphere very much richer in sodium chloride vapour than that of the coke-oven during carbonization. What happens is that the fire-brick fire-clay surface is attacked, and a glaze is formed of sodium aluminium silicate—the so-called salt-glaze. This coating having once been applied to the whole exposed face, any further attack of salt vapour proceeds slowly, and with little or no penetration to any part of the fire-brick which lies at the back of the face in the interior of the brick.

The essential condition for securing this comparative immunity from further destruction is that the salt vapour shall not come into contact with the fire-clay face until the temperature of the latter is so high that any compound formed is in a state of fusion. This temperature is about 1200° C. If sodium chloride vapour is allowed contact at temperatures below this, the result is quite different and, in its practical effect for our purpose, much more serious. It has not been realized in the past with sufficient clearness that combination can occur between substances which have for each other sufficient chemical affinity, even when both substances are in the solid state. The combination of lime with silica, or with alumina, at a red heat far below the melting-point of either combining constituent, or of the compound formed, is perhaps the most striking example of this phenomenon, and has been completely demonstrated.*

So far as concerns the formation of sodium silicate, sodium aluminate, or sodium aluminium silicate, the same general principle applies. The interaction of soda and alumina has been traced by experiments, in which a mixture of sodium carbonate alumina and silica corresponding with the formula $Na_2CO_3 + Al_2O_3 + 10\ SiO_2$ was heated to successively higher temperatures, and the degree of interaction determined at each of these temperatures by suitable chemical examination. I reproduce the table of results [see next page].

It was clear that chemical interaction had occurred at comparatively low temperatures, and that compounds were formed, not in fusion at the time of their formation, but ready to fuse when higher temperatures were attained. Applying this result to our analogous case, we may be quite prepared to find that below the temperature of salt-glazing there is not only a penetration of salt vapour into the interior of the porous brickwork, but a fixation of the salt which has so penetrated by chemical combination with the alumina and silica present.

The following experiment may be useful as indicating what amount of sodium chloride can be fixed in water in soluble compounds, when extensive facilities for interaction between common salt and fire-clay are afforded. Finely-ground calcined fire-clay was mixed with a considerable excess of common salt, and was gradually brought up to a temperature of 1200° C. in a works furnace; the time occupied being 72 hours. The sintered mass, from which most of the sodium chloride had evaporated, was extracted repeatedly with water, until the washings contained only traces of soluble salt; and the residue was then analyzed. Its formula was very approximately $Na_2O, 2Al_2O_3, 7SiO_2$, indicating something like the same degree of fixation of soda as found in felspar.

Deduction from laboratory experiments carries us so far; but observation of another kind in large-scale work has shown more. In the ordinary type of salt-glazing kiln, salt is not applied to the fires, and therefore does not reach the interior of the kiln, until the fusing temperature of the resulting glaze has been practically attained; and the excess salt fumes pass straight to the chimney. In a continuous gas-fired salt-kiln which was some years ago in my charge, some of the salt fumes passed through from the chamber in which salt-glazing was being effected to another chamber in

* See "Journal of the Society of Chemical Industry," "Synthesis of a Silicate." Cobb, 1910, p. 250.

Soda, alumina, and silica ($Na_2CO_3 + Al_2O_3 + 10\ SiO_2$.

$Na_2CO_3 + Al_2O_3 + 10\ SiO_2$ contains { Na_2O . . 7·7 per cent.; Al_2O_3 . . 12·6 ,,; SiO_2 . . 74·2 ,,; CO_2 . . 5·5 ,, }

$Na_2O + Al_2O_3 + 10\ SiO_2$ contains { Na_2O . . 8·1 per cent.; Al_2O_3 . . 13·4 ,,; SiO_2 . . 78·5 ,, }

Where Heated.	Time (Hours).	Temperature Deg. C.	Soluble in HCl. Na_2O.	Soluble in HCl. Al_2O_3.	Soluble in HCl. SiO_2.	SiO_2 in Na_2CO_3.	SiO_2 Total Soluble	Total Soluble.	Total Insoluble.	Appearance.	Notes.
		Blank	6·1	..	0·3	..	0·3	6·4	93 6		Na_2O less than theoretical
Muffle. . .	1	800	6 9	0·2	0·5	3·6	4·1	11 2	88·8	Hardened	
,, . . .	1	1000	0·8	1·0	0·6	0·9	1 5	3 3	96 7*	Hardened	* By difference
									96·7†		† Determined $NoCO_3$
,, . . .	1	1150	0·6	0·8	0·6	0·8	1·4	2·8	97·2	Very hard, not fused	
,, . . .	1	1300	0·6	1·8	1·3	0 7	2·0	4·4	95·6	Stony fusion	
Works furnace	24	1150	1·0	0·4	0·2	0·6	0·8	2·2	97·8*	Stony fusion	* By difference
									97·2†	Slightly honeycombed	† Determined SO_3 = 0·4 per cent.

which the temperature was lower. Examination of a test-brick from this second chamber, when the salting in the first chamber was completed, disclosed no obvious change other than the formation of a slight brownish stain on the yellow face of the brick. When, however, the temperature of the second chamber was raised to make it ready for salting, a strange phenomena, new to me, declared itself, inasmuch as the face of most of the bricks began to blister badly; and for some distance below the blistering the fire-clay was semi-vitrified and honeycombed. Chemical examination showed that soda was present in quantity.

In this case, then, as in ordinary salt-glazing, the interaction of the salt and fire-clay had resulted in combination; but the practical difference of a chamberful of bricks blistered and honeycombed on the one hand, and of smoothly glazed, exactly shaped bricks on the other, was a clear indication that the conditions in the first case—not merely the presence of salt and fire-clay—were the determining cause of the harmful effect. These conditions determined the penetration of the porous brick by the salt vapour below the temperature at which a glaze could form, the formation in the solid state of compounds between the soda and the brick substance, and, finally, the fritting and fusion in the mass, as well as on the face, when the temperature was sufficiently raised at a later stage.

From this point of view, the destruction of the wall in a coke-oven by the salt in the coal carbonized takes place somewhat as follows. At a comparatively low temperature, the salt in the atmosphere of coal gas volatilizes, and, penetrating into the brickwork, combines with its substance. In so doing, it alters physically, and chemically also, the composition of the portion of the wall nearest the face. The temperature of the brickwork is lowest near the face, highest near the combustion flues, and rises gradually from one to the other. The temperature near the face is not sufficiently high to fuse the soda alumina silica compounds formed there. But these compounds have also formed further in, where the temperature is higher; and tracing the temperature towards the inside of the brick, a point is reached where the temperature is high enough to effect fusion—to produce liquidity, porosity, honeycombing, and rottenness of structure making for disintegration.

Herein lies the danger. The brickwork begins to fall away in pieces—to "chatter." It is destroyed, not by the gradual removal of successive thin layers by fusion, but by a much more drastic process of breaking off layers of considerable dimensions. It is very likely several other phenomena come into play in bringing about this final result. As a consequence of chemical alteration in that portion of the fire-brick into which the salt vapour has penetrated, there is an accompanying physical change in co-efficient of expansion which may have considerable influence. If the outer layer is expanding and contracting every time the oven is heated and cooled, to an appreciably different extent from the substance at the back of it, this is, in itself, a disintegrating force, and the somewhat vitrified, and therefore more coherent, facial portion of the brick may very well tear itself away as a whole from the entirely unvitrified, and therefore the less coherent, substance behind it.

Another phenomenon which may be of some consequence is the volatilization of iron in the form of chloride of iron, which undoubtedly takes place, followed by the deposition of iron—probably in the metal form, because the atmosphere is reducing—when the volatilized chloride penetrates to a region where the temperature is too high to permit of its continuing in existence; or the ferric chloride may penetrate to a point at which it meets with free oxygen penetrating in the opposite direction from the combustion flue, and oxide of iron is deposited. A layer of oxide is frequently found on the plane of disintegration, when the brickwork of a failing oven is examined after cooling-off.

Laboratory experiments carried out for me by Mr. C. P. Finn demonstrated conclusively the volatilization of iron as chloride from fire-clay, and its after-deposition as oxide under proper conditions. I have noticed the same thing occurring on a large scale when a stream of salt vapour impinges on the bricks in the process of salt-glazing, without having been thoroughly mixed with air and the products of combustion.

There is one change brought about in the structure under the face of the bricks lining the coke-oven which has not so far been insisted upon, or even mentioned, because it occurs even in the absence of salt; but it is a change which may have its own influence in producing disintegration. It is the deposition of finely-divided carbon in the pores of the fire-brick, by the decomposition of methane and other hydrocarbons present in the gas driven off from the coal during its carbonization. Another change which has to be taken into account is the reduction by these gases of the iron contained in the fire-brick from the ferric to the ferrous condition, in which its fluxing power is materially increased. As a result of such action, any small area rich in iron will become doubly dangerous as a centre of fluxing and disintegration.

Suggestions for Curing the Trouble.

So far I have treated of the disease, rather than of the remedy; and at the present moment I put forward no remedy, but would rather like to indicate the lines on which a cure can probably be effected, if proper co-operation is secured between the makers of refractories on the one hand and the coke-oven builder and manager on the other.

In the first place, it is obviously advisable to minimize the amount of penetration through the face by the use of practically non-porous material in that position. Complete exclusion can hardly be hoped for, unless a suitable glaze can be found for both brick faces and joints; and it has to be borne in mind that the repeated expansion and contraction which the face undergoes is the very severest possible trial to the cohesion of the glaze and the material that is behind it. If, then, penetration occurs, the material should be one which will suffer as little as possible from the fluxing of the soda. Among refractories which can be supplied in any quantity, alumina and magnesia stand out as offering distinct possibilities. Alumina does combine with soda, but to form an infusible compound which is decomposed again without fusion when the temperature rises very high.* Pure alumina is a very expensive material; and the commercial form for our purpose would be bauxite, which contains silica, oxide of iron, and titanium oxide, as impurities. There is, however, one very grave objection to the use of bauxite, or any similar form of alumina, for any high temperature work; and this is the great difficulty of "getting the contraction out of it" by any ordinary calcining. A shrinkage in use is commonly experienced. The use of the electrical furnace may with alumina, as with silica, give us a material with excellent properties; and something has already been done in this direction. But the cost of these materials in bulk is likely for many years to come to be prohibitive. Magnesia is another refractory which offers a very high order of resistance to soda; but here, again, the factor of cost is against it. Thin impervious facing layers of these more expensive materials should, however, be carefully considered and tried.

Taking it for granted that fire-clay bricks continue to be used, it is well to consider what conditions they should satisfy. In the first place, the face should be close-grained, and the face and sizes made so exact as to allow the use of small joints. Then the substance should be of a composition physically and chemically best adapted to resist the fluxing action of the salt. Free silica in the brick requires special consideration, because it may act in two directly opposite ways. If it is very finely divided, so as to bring it into effective contact with the clay material, the silicate of alumina, fluxing is enhanced. If, on the other hand, the silica grains are large, the fluxing action of the salt is confined largely to their exterior, and a state of affairs is readily attained in which the clay and fine silica, attacked by the salt, have formed a pasty mass, stiffened and strengthened by the silica grains.

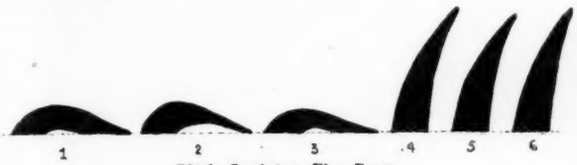
This difference in the action of fine and coarse silica is equally noticeable in its influence on the fusibility by heat alone of clay and clay-silica bricks. A mixture of alumina and silica containing from 80 to 90 per cent. of silica, is, when all the constituents are finely divided, the most fusible of all such mixtures; but the same mixture when the silica grains are coarse does not fuse as one, but more nearly with the average fusibility of its two constituents. This beneficial effect of large-grained silica is due to the minimizing of its interaction with the other material present, which can only take place on the interfaces of particles. It is not that the largeness of the particles in itself increases the stiffening effect, as can be illustrated by a simple experiment which was carried out for me by Mr. C. A. King, in the laboratory of the Farnley Iron Company.

* See "Journal of the Society of Chemical Industry," "Synthesis of a Silicate." Cobb, 1910, p. 403.

The problem was: Given a substance which was softening slightly and bending gradually with its own weight, what size of particle could be most effectively used to counteract the bending when no chemical action was possible between the softer and the harder substances? A pitch was chosen as the slightly softened constituent which, made into the form of a pyramid, like a Seger cone, but 8 inches higher, bent slowly until it lay flat on its support. The stiffening constituent used was ganister; and it was added in different grades of fineness in making a set of pyramids which were placed side by side in the laboratory at the ordinary temperature, and observed. The mixings used are given below, and also the time taken for each pyramid in bending to touch.

	Times of Touching.
No. 1 pitch alone.	22 hours.
No. 2 50 p. ct. pitch and 50 p. ct. sand between 3 and 8 to the inch	4½ days.
No. 3 ,, ,, ,, ,, ,, ,, 8 ,, 25 ,, ,,	3 ,,
No. 4 ,, ,, ,, ,, ,, ,, 25 ,, 50 ,, ,,	26 ,,
No. 5 ,, ,, ,, ,, ,, ,, 50 ,, 100 ,, ,,	30 ,,
No. 6 ,, ,, ,, ,, ,, passing through the 100	23 ,,

The accompanying figure shows the degree of bending attained after five days.



Pitch-Ganister—Five Days.

The result of this experiment was decisive in showing that the coarse-grained hard material had actually less stiffening influence on the softer pitch than an equal proportion of the same substance in smaller grains. The admixture of ganister particles of any size did, however, effect some stiffening.

Enough has now been said, I believe, to set out the complex considerations, physical and chemical, which enter into this problem of refractory materials and salty coals; and if any line of either thought or action has been indicated, in however sketchy a manner, which will lead to a satisfactory solution of the problem, not only the coke-oven industry, but the other carbonizing and coal-using industries in general, will have an obstacle removed from their path.

[Professor COBB mentioned that the specimens had been supplied by Mr. C. P. Finn.]

DISCUSSION.

The CHAIRMAN said there was much matter for thought in the lecture. They would all welcome the appearance of the lecture in the Press, so as to be able to study it closely at leisure. At the same time there would doubtless be points upon which they might like to question the Professor that evening. His own experience of heated coals and refractory materials had borne out all the Professor had said in a remarkable degree. It was his own unfortunate privilege to have a battery of horizontal-flue ovens and a battery of vertical-flue ovens; and, as all knew, the temperature varied considerably between them. The salt action in the vertical oven was nearly double what it was in the horizontal, showing, as Professor Cobb had pointed out, that a difference of 50° was a very serious thing. Where he could get an oven wall to stand for two years with a temperature of 800°, he could not get it to stand anything like this time with a temperature of 850°. With regard to what had been said about iron. Being disagreed with on many occasions by people in regard to iron, he was glad Professor Cobb had cleared up the question for him.

Mr. T. N. RILEY said the subject of salty washing water was one that exercised his own attention largely. In washers where the slack was treated preparatory to entering the ovens, they could not get rid of their circulating water; and as time went on the slack became saturated with salty water. In connection with the washer at his own plant, they were dealing with 500 tons of slack per day, and about 50 per cent. of this went to the ovens. The fresh water they used contained about 0·025 per cent. of salt; the water which was actually in circulation contained 0·18 per cent. The drainage water from the washed coking slack bunkers contained 0·024 per cent., and was conveyed outside the buildings to a drain. It amounted to about 2000 gallons per day. The coal in the ovens, also, contained about 0·02 per cent. of salty water. This salty water was really a point which needed watching, to get free from it.

Mr. T. P. CARR asked the opinion of the lecturer on the use of fire cement with sodium silicate.

Professor COBB said there was a great deal of difficulty in any case of this sort with the co-efficient of expansion. To secure adhesion with cement was not a difficult matter when the cement was put on while the walls were new; but alterations which took place by the action of the salt on the material of the cement had to be considered—chemically because it might be chemically detrimental, and, physically, because it might so affect the co-efficient of expansion of the applied cement that it would no longer adhere to the wall. This seemed to him entirely a matter of experiment.

Mr. CARR remarked that he was speaking of a wash of the salt.

Professor COBB replied that he supposed, however, the assumption was that it was going to give a complete glaze. Sometimes it did give a complete glaze. This would be adherent, but sometimes one which was not adherent very long. It was very difficult to get a cement which could be expected to serve for all purposes. He did not say it was not possible; but to give a definite verdict on a subject of this sort would be difficult.

Mr. G. STANLEY COOPER said it seemed to him that they had to look upon these questions from two main points of view—the purely scientific view of getting at the cause, and the practical point of view of dealing with it. He had rather expected that Professor Cobb would have dealt more particularly with the practical point of view of overcoming the difficulties. There had been a lot of correspondence in the Technical Press lately as to whether the silica brick or the alumina brick was better adapted for dealing with coal of a salty nature. He was perfectly convinced, personally, that the silica brick "had it;" but he knew there were some present who were just as convinced that the silica brick was "rotten." He personally had to deal with one of the most notably salty coals in this country; and he had found it best to use silica brick. He was also in the unhappy position of experiencing the salty water trouble mentioned by Mr. Riley. They had here a good opportunity of seeing how the silica brick would stand it. There was another point which might have some bearing on the matter, and one which had puzzled him very much, and which Professor Cobb had cleared up. He meant with regard to the temperature factor in the action of the salt on fire-clay material. The temperature at which the brick was exposed played an important part in the ultimate action of the salt on the brick. Some experiments were conducted a year or two ago at Birmingham, and it was shown conclusively that bricks with a higher silica content withstood the action much better than did the lower silica bricks. But there was another factor—a question of temperature—which was not taken fully into account. Above a certain temperature the action of the salt was very much minimized. The higher silica may thereby fail, and, as a coincidence, the lower silica bricks may answer better. Temperature in the flues at Birmingham was generally in the neighbourhood of 200°. The physical structure of the brick was also one of the most important points. The lecturer mentioned having a brick of a close texture to resist the action of salt better. In regard to the action of sodium chloride on the iron, if they took out the mass of common salt before extracting, they could extract a considerable portion of the iron. It had been suggested, he believed, that it was neither the sodium nor the iron, but the chloride. He would like to have Professor Cobb's opinion on this.

Professor COBB said he was afraid that he must have been misunderstood if he gave any impression that the higher temperature minimized the action of sodium chloride. The point had been that, supposing they put a fire-clay to higher temperature, and the sodium chloride attacked it at that temperature, they would get a glaze formed which was nearly impervious. Even if a coke-oven were worked at a higher temperature, before it reached that higher temperature it had to pass through the lower temperature, and in this lower temperature the action of the sodium chloride which he had described could occur. They were not at that time fused, but being raised to a higher temperature were then fused, or as the higher temperature of the ovens rose.

Mr. J. W. LEE, interposing, said they had understood that the Professor meant a physical change had taken place at the lower temperature.

Professor COBB said that was so, and a chemical change as well. But this very chemical change which resulted from fusion did not take place until the higher temperature was attained.

Mr. COOPER: But suppose you attain the higher temperature before you introduce the salt?

Professor COBB said if they did this they would get a soft glazing of the interior of the oven.

The PRESIDENT said, in view of the statements in the lecture, and raised by Mr. Cooper, he would ask what was the possibility of having a glazed brick as an advantage against salt attack?

Professor COBB said they were there up-against the difficulty of the co-efficient of expansion. The glaze—any ordinary glaze which was used—would be cracked off.

Mr. C. P. FINN said he thought the Professor's explanation as to the differences between the glaze and the actual attack of salt on fire-clay in a heated condition could be brought home to those with coke-ovens if they compared the condition of the arches with that of the walls. The arches, although they were covered with a salt glaze, were quite different from the disintegration of the brick itself. As the salt penetrated the brick it got nearer to the actual source of heat—the inside of the flue—and therefore it was reaching a higher temperature, and there was a point at which incipient fusion began to take place. They should compare the glazing of the arches with the actual salt corrosion of the walls.

Professor COBB, in answer to a question which had been raised by Mr. Cooper, said there was, of course, a difference in the amount of volatilization which took place from various compounds of soda; and sodium chloride was probably the worst in respect of any of the ordinary compounds. But he took it they had to deal with the sodium chloride as it existed there.

Mr. E. M. MYERS raised a point with reference to ammonium chloride. There was no doubt that in salty coals the formation of this was governed largely by the amount of chlorides existing originally in the coal. He would ask the lecturer whether the formation of ammonium chloride which took place after the volatil-

ization of the sodium chloride had any bearing on the disintegration of the refractory material.

Professor COBB said he was afraid he could not satisfactorily answer this question. The presence of ammonium chloride, he had always taken it, was rather to be regarded as indicative of the presence of sodium chloride in the coal originally, so that the formation of sodium chloride was accompanied by the presence of ammonium chloride. But he should certainly trace no connection between ammonium chloride itself and the factors of disintegration.

Mr. MYERS said it ammonium chloride were heated in contact with refractory materials, the materials underwent a tremendous amount of disintegration.

Professor COBB asked under what conditions this occurred. Did Mr. Myers mean in the liquor form?

Mr. MYERS: No, salt.

Professor COBB: Is the salt supposed to be on the surface?

Mr. MYERS: Yes.

Professor COBB said they might, under certain conditions, get a dissociation of ammonium chloride. It was not a matter to which he had given special consideration.

Mr. W. GREEN said he wondered if an idea which had occurred to him might have any effect, with reference to the production of hydrochloric acid in the coke-ovens. It was usually found that there was also a high content of ammonium chloride. At the temperature existing in the oven, he did not think the ammonium chloride would exist there. With the hydrochloric acid existing there, would it not have an effect on the brick, resulting largely in this disintegration?

Professor COBB said the question was in substance the same as the one raised by Mr. Myers; and the answer was the same.

Mr. MYERS said he did not think there was any doubt that ammonium chloride did not begin to assert itself until it reached the cooler temperature of the hydraulic main.

Mr. A. R. FLEMING said Professor Cobb seemed to have entirely cleared up the cases for corrosion due to salty coals. With regard to the £ *s. d.* of the subject, it would appear to him that the limit which they would set before they considered it necessary to adopt special qualities of fire-bricks—the limit of percentage in the coal—should not be over 0·3 per cent. of sodium chloride. Of course, those with a wider experience of different qualities of coal with regard to the salt would no doubt have something to say on this subject as to the limit. He also understood, with regard to the remedy proposed by Professor Cobb, that the idea was to get a fire-brick with a coarsely crystalline silica base, and yet with a fine and coherent surface. But, in addition, the co-efficient of expansion between the large-grained silica base and the fine-grained surface should be practically the same—there should be no wide difference in their co-efficient of expansion. He would suggest whether it should not be possible and advisable, in the case of coal containing a high percentage of salt—say, over 0·3 per cent.—to glaze the surface of the coarse-grained silica brick by means of a very high-temperature flame. That was, actually to make the fine coating on the surface of the brick a fused silica. It would appear to him that in this way they overcame any difference in co-efficient of expansion as between the surface of the brick and the inner portions. Of course, it would cost more to treat bricks in this way; but if the coal was very salty, it might be possible that the advantage of having this done would make the ovens last so much longer that the cost would only be a negligible factor as against the advantage derived.

Professor COBB said the idea seemed quite satisfactory, except from the point of view of the brickmaker. The process of bringing the surface of the brick to the necessary point without breaking the brick, was a practical difficulty of an exceedingly grave character. It would mean that, for the time being, they would have such great local differences of temperature that it would be an extraordinary material that would stand the strain.

Mr. GREEN asked if they might draw any inference from the case of the American steel facing. Up to the time of adopting this, there had been excessive trouble in the lining of the furnaces; but now they had in use a furnace so treated which had lasted two years, and it might possibly be adopted in the case of coke-ovens, though it might appear a revolutionary idea. In reference to the two coals, there had been instances of more action upon the walls in ovens using low percentage of salt coal than with a coal of high percentage.

Professor COBB said he should be interested to have the reference to the experiment made with steel-faced bricks. It was quite new to him. As to the curious anomaly mentioned by Mr. Green in regard to the two coals, he was afraid such anomalies were a matter of common experience and were one of the difficulties of dealing with the subject.

The PRESIDENT raised a point as to the amount of dirt in the coal.

Mr. GREEN said if people would have a chemical analysis of the bricks used and remark as to their appearance and method of using, the Association might be able to build-up data which would help the industry to solve the trouble.

VOTE OF THANKS.

The PRESIDENT said they had had an exhaustive discussion. It only remained for him to endeavour to express their appreciation of the lecturer's valuable contribution to their records. He moved a hearty vote of thanks to Professor Cobb.

Mr. B. WILSON HAIGH, in seconding the motion, said Professor Cobb was an ideal combination of a practical man and a University professor. They would all have much data from the lecture to go upon in getting the right kind of material for settling these awkward problems.

Professor COBB, in a brief response, said it had not so much been his intention to place before the meeting any complete remedy for the troubles which occurred in the coke-oven industries on account of the salt contained in the coal, as to give what was, in his mind, a view of how these troubles did really come about, because it was essential to understand the nature of the disease before one could work systematically for a complete cure.

[Professor Cobb then conducted the members on a tour of the University metallurgical laboratories.]

EXTRACTION OF BENZOL AND TOLUOL BY AMERICAN GAS OIL AND GREEN OIL.

Mr. John Bond's Experiences with American Gas-Oil—Mr. Hubert Pooley's Work with Green Oil.

At the Meeting of the Midland Association of Gas Engineers and Managers, at the Grand Hotel, Birmingham, last Thursday—the PRESIDENT (Mr. C. H. Webb, of Stourbridge) in the chair—Mr. JOHN BOND, of Southport, and Mr. HUBERT POOLEY, of Leicester, opened a discussion on the subject of the extraction from gas of benzol and toluol. Mr. Bond recounted his experiences with American gas oil, and Mr. Pooley with green oil.

Extraction with American Gas Oil.

Mr. BOND said he should like to thank the Committee of the Association for inviting him to be present that day; and, at the same time, he wished to take the opportunity of thanking the members of the Association who had, through many difficulties, continued the tar-washing of their gas for toluol. The position with regard to toluol was most satisfactory; and the members would probably be pleased to know that about 25 per cent. of the toluol content of the gas was being extracted. He did not want the members to relax their efforts in this direction. But what he wanted to impress upon them more was that the Government required large quantities of benzol—not only for the nation's requirements, but also for France, Italy, and Russia. France was suffering very severely through the loss of the principal coke-ovens in Flanders. This had been a double loss to them, because their loss was the gain of the Germans. He (Mr. Bond) wanted gas engineers to exercise all the ingenuity they could possibly bring to bear upon this subject, and to fit up washing plant for the recovery of benzol. When extracting benzol from the gas at Southport, they did not stop the process of washing by tar—that was worked by the "C" process. First of all they tried creosote oil washing. Unfortunately some of the parcels of creosote oil contained an excessive amount of naphthalene, and this interfered considerably with the gas supply. One parcel of it came charged with about 22 per cent. of naphthalene. He then tried to get a certain amount of anthracene oil, but was not successful in obtaining this. Therefore he turned his attention to washing the gas with Anglo-American gas oil, which at that time he purchased at 2$\frac{1}{8}$d. per gallon. He thought the present price was something like 6$\frac{13}{16}$d. The method of extracting benzol was very simple indeed; and he would therefore just explain what had been done at Southport, and how they had been able to utilize a certain amount of old apparatus in getting out quite a considerable amount of benzol. The scrubber shown on the diagram was 30 feet high by 8 feet diameter; and it was filled with boards. Oil, which was stored in a tank for the day's requirements, was first of all pumped into a circulating tank, holding about 550 gallons. It was then passed through the distributor at the top of the scrubber, and circulated at the rate of 6 gallons per 1000 cubic feet of gas. It was circulated for six hours only. If they circulated it more than that number of hours, there was a considerable reduction in the benzol, as well as in the toluol. He should be pleased if those interested in the matter would consult the curve [exhibited]; they would see the rapid increase in total products up to 145° C. Also that the benzol curve suddenly decreased after the washing had been continued more than six hours.

Mr. SAMUEL GLOVER (St. Helens): Is that in the washing oil?

Mr. BOND said it was. After being pumped round the scrubber for six hours, the "treated" gas oil was pumped into the storage tank at the tar-works. Then it was passed through a Wilton dehydrating coil, on top of which is a small pot containing a steam-jet. The oil passing through the coil at a pressure of 10 lbs. was heated up to a temperature of 110° C.; and they were able at that temperature, with the help of the steam, to get over the whole of

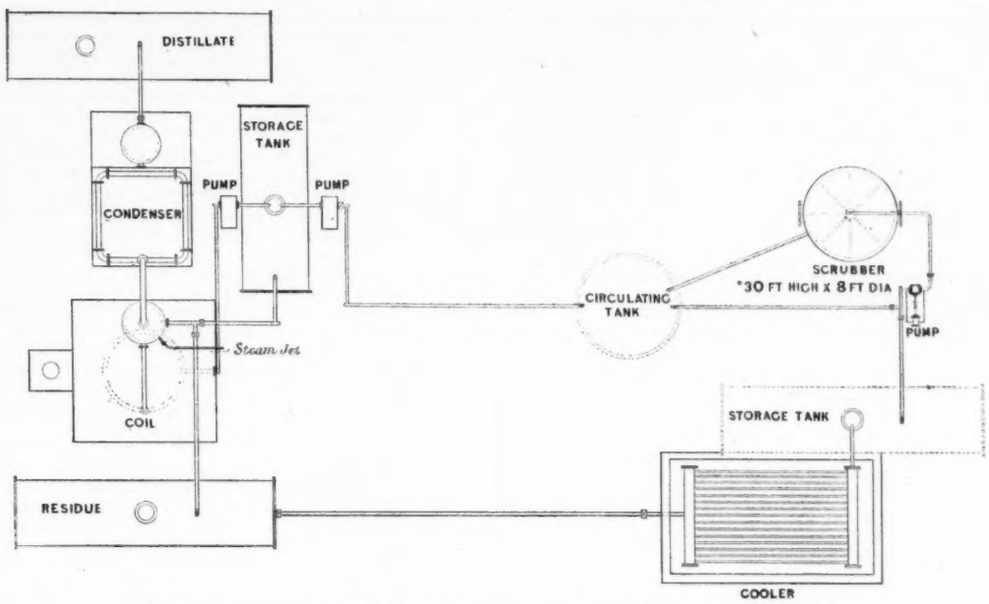
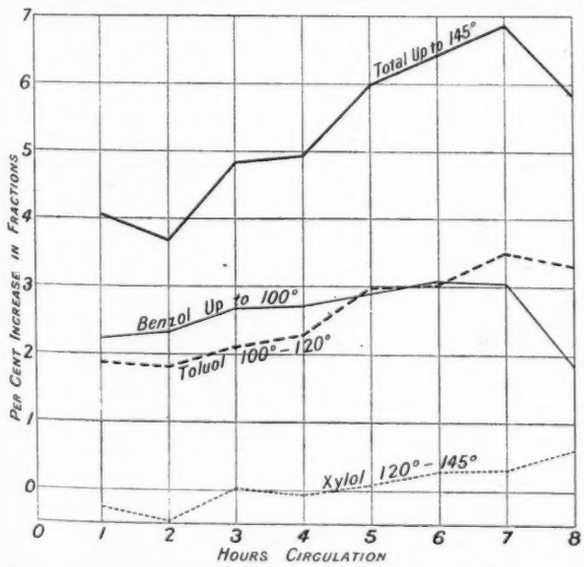


DIAGRAM OF PLANT FOR THE OIL-SCRUBBING PROCESS AT SOUTHPORT.

the crude benzol. The distillate condensed in the small condenser shown on the diagram passed into the storage tank. The residue went forward to a second tank; and after it was cooled, it was passed into the storage tank to be used again in the scrubbers. Perhaps the members would like to know something as to a test of the gas oil used. The specific gravity of it at 15·5° C. was ·859; and the flash point, 125. The first drop came over at 190° C. Up to 300° C., 28 per cent. of the oil came over—leaving a residue of 72 per cent. After using the oil by passing it ten times through the plant, a test was as follows: Specific gravity, ·9025; and flash point, 104. The first drop came over at 158° C.; and there was 27 per cent. of oil up to 300° C.—the residue being 73 per cent. The process of oil washing was intermittent, because the dehydrating coil was used in conjunction with stills for tar distillation. These experiments were started in December; and up to now something like 6000 gallons of crude benzol had been recovered, for which he had received 8¼d. per gallon. He thought that, in the majority of



gas undertakings, the engineers should consider the advisability of putting down dehydrating plant, because he believed that, in the future, it would be most useful; the rest of the plant could, in his opinion, be constructed in their own shops. He believed that they would as an industry have to take a keen interest in all the products, especially the tar products. At the present time, these were selling at a low figure; but he believed the necessities of the dye industry would have to be largely met by gas undertakings. In this respect, it would be helpful to have some form of dehydrating plant. This was the reason he advised the members to consider seriously the installing of this class of plant. He had a number of tests with him as to the points at which the crude benzol distilled. The whole of the benzol collected from Dec. 5 (when the plant was started) to Feb. 16 contained 75 per cent. of products coming over at a temperature of 147° C. He found on going through the analyses of the gases taken at various gas-works, that the gas contained approximately 10 lbs. of benzol per ton of coal carbonized. In some works, it was less than this amount; in some works, very much higher. But he believed they could successfully recover about 4 lbs. of benzol and toluol apart from the "C" washing process, by judiciously washing their gas with some form of oil, whether it be anthracene oil or Anglo-American gas oil. In his own case, they had recovered approximately 4 lbs. of benzol and toluol per ton of coal; but they had been as high as 6 lbs. By recovering 4 lbs., their illuminating power had been reduced about 2½ candles below the statutory requirements; the standard in Southport being 16 candles. The effect on the calorific value of the gas had not been very great. They had reduced it so far as he had ascertained from 530 to 490 B.Th.U. net. If gas engineers would care to go further into this subject of benzol recovery, or if they came across any difficulties, he would be pleased to get into communication with them, and give any information he possibly could on this most important subject. He did hope that they would seriously consider the matter, so that the nation would be in a position to manufacture the high explosives which they at the present time required.

Circulating Gas Oil through Tower Scrubber—March 15, 1916.

Oil circulated for eight hours through tower scrubber, passing gas at the rate of 75,000 cubic feet per hour, oil circulated at rate of 410 gallons per hour, and samples taken every hour.

Hours' Circulation.	First Drop ° C.	Percentages Absorbed.			
		Up to 100° C.	100°–120° C.	120°–145° C.	Total up to 145° C.
1	54	2·23	1·86	·025	4·06
2	42	2·33	1·81	·45	3·69
3	50	2·68	2·10	·05	4·83
4	56	2·70	2 28	·05	4·93
5	47	2·93	2·95	·1	5·99
6	49	3·08	3·05	·3	6·43
7	53	3·05	3·50	·33	6 88
8	55	1 86	3·31	·65	5 82

Washing with Green Oil.

Mr. HUBERT POOLEY (Leicester) said he did not think that he could offer to the members in green-oil washing any prospective profits. The process was not an easy one; but he felt that, in attempting to denude the gas of benzene and toluene, they were taking a patriotic step; and it was on these lines he should prefer to preface the few notes he proposed to give. They commenced the "C" process in two of their works in which they had four sections. Quite early, and right throughout the experiments, very poor results indeed were obtained at their large works, where they were producing 4½ million cubic feet of coal gas a day; but, at the smaller works, where rather less than 2½ million cubic feet per day were being produced, very good results were realized. In one section of the large works, they produced only 600,000 cubic feet a day; and in July of last year he decided to collect all the green oil they made, with a view to washing the gas from this particular section. He anticipated—and he was not disappointed—that they would practically denude the gas of its illuminating power; but he intended to pick up with carburetted water gas and reduce the make per ton somewhat in the larger section of the works. They managed to collect by January of this year 16,000 gallons of green oil. He then laid off No. 1 section of the Aylestone works for green-oil washing. Roughly, some 55 tons of coal were being carbonized per day in this section, producing about 600,000 cubic

feet, or approximately 11,000 cubic feet per ton. Two washers were arranged after the scrubbers. In the first they washed for naphthalene, using the Colson process; in the second they washed with green oil. They were compelled to take this sequence (which was obviously wrong), as they could only bye-pass the second of the washers. After two washings, and after talking over the matter with Dr. Colman—who was good enough to visit the works after the first remarkable series of washings—he reversed the order of the washers, making some alteration to the connections, and he was now washing for benzene and toluene first, and naphthalene second. When commencing, the green oil had a specific gravity of 1080; and, after twenty-four hours' working, it fell to 1066. In the distillation of the green oil, they obtained the first drop at 78° C.; and up to 170° C. they obtained 7·7 per cent. This washing was carried on for 144 hours, at the end of which time the specific gravity of the oil was only reduced to 1056; and the total distillate below 170° C. was only 13·4 per cent. From this he was able to judge that the first twenty-four hours was the richest period in result. So far as they were concerned, it was not a difficult matter to isolate one section of the works, and to pull up the candle values to a point. But a considerable time elapsed before they could collect sufficient green oil to commence working; and if any attempt were made to wash generally with green oil, there would certainly be a great shortage in the supply of material. Where flat-flame burners were used, the greatest possible inconvenience would be felt by consumers. Experiments on similar lines might be conducted in other works where the manufacture was divided up into sections—laying off one or more sections for the particular purpose. The results of green-oil washing were that they produced per ton of coal 13·6 lbs. of benzene and 5·28 lbs. of toluene. These results were very remarkable; and Dr. Colman came along to see if he could find any difference. His test showed 13 lbs. of benzene, and 3·9 lbs. of toluene. There was thus a large difference in the toluene content between Dr. Colman's figure and their own. A discrepancy was discovered in the thermometers used, which accounted to a certain extent for some of the difference. Unfortunately, there was no more of the original sample left. In the second charge, the results were not so good. His assistant responsible for this section of the works did not carry on the washing quite to his instructions. His instructions were that the washing should be continued until the gravity of the green oil was reduced to 1065. The mistake was made that the hard-and-fast rule was set to the workmen that they should wash for twenty-four hours. The green oil only tested 1076 at the end of the time. The result was that they obtained 7·18 lbs. of benzene and 1·98 lbs. of toluene. After this they improved; and he thought that he could give the results better in another way. The green-oil washing was proceeded with throughout seven periods of twenty-four hours. The average quantity of gas washed was over 600,000 cubic feet; and the make approximately 11,000 cubic feet per ton. He would give the series of benzene and toluene results in gallons taken from the total quantity of gas—600,000 cubic feet being the quantity for each series:

Approximate Gallons Taken from the Gas.

	Benzene.		Toluene.	
	76	..	28	
	42	..	12	
	105	..	34	
	64	..	8	
	41	..	10	
	38	..	18	Total benzene
	72	..	12	and toluene,
	438	..	122	560 gallons.
Average	62·5	..	17·4	79·9 gallons. per washing.
Taking 61 tons of coal, average per ton of coal . . .	1·02	..	0·28	1·30 gallons. per ton of coal.

From the washings this was equal approximately to 9 lbs. of benzene per ton of coal and 2·7 lbs. of toluene. The results were exceedingly encouraging. His greatest trouble was that they were forced to work intermittently. It took them about twenty-four hours to change their washers, and in this respect the system of working was not satisfactory. If they could lay-off a second section of the works and get continuity, it would be better; but the effect on the calorific value and illuminating power of the gas was such that he could not see his way to go farther at present.

Further Information and Interrogation.

Mr. J. Ferguson Bell (Derby) said the members would desire to tender their thanks to Mr. Bond for giving them such an interesting statement regarding the recovery of benzol and toluol by American gas oil. They were glad to know that the efforts of the gas industry, supplemented, of course, by the coke-oven industry, had been the means of enabling the Government to overcome the shortage of toluene. He was quite certain that the gas industry, which responded so willingly to the desire of the Government for supplies of toluol, would be equally emphatic in respect of benzol. He should like to tender to Mr. Bond his personal thanks for the information he had been good enough to give him in respect of this interesting process that he had worked out at Southport. There was no doubt that the gas industry in future would have to turn more attention than in the past to the profitable utilization of the residual products, and to the supply of gas of a lower illuminating power and of possibly a lower calorific value than had now to be given, and which would be found equally to the advantage of the consumers. In the future, after what was now being done, they would no doubt be able to convince Parliament that candle power was unnecessary, and that a calorific value of something like 500 B.Th.U. was all that was required. The figures given by Mr. Bond were most remarkable. He took it that he extracted something like one-third of the benzol and one-third of the toluol, and that the reduction in candle power was from 16 to 13½ candles, tested by the No. 2 burner. The 13½ candles was, of course, a good illuminating power; and he thought that in the future they would be able to easily come down to about 12-candle power, and satisfy all their consumers, even those who still persisted in using flat-flame burners, and who were now in the minority. The reduction of B.Th.U., he understood, was from 530 to 490 net. He believed Mr. Bond said he used the washing oil ten times.

Mr. Bond: We have now circulated it until it has been used twenty times. The test was for ten times.

Mr. Bell said it was his intention to introduce the process, and there were many other members who would want to do the same. Mr. Bond would therefore, he was sure, be pleased to give information. He (Mr. Bell) would like to know what was the loss of oil. He took it there would be some loss. Mr. Bond started with 450 gallons; and of this, what was the proportion of loss?

Mr. Bond: On Dec. 5, we had 3720 gallons of the original gas oil; we have now 3200 gallons. So you see there is very little loss, especially when one considers that the oil has been used for a large number of experiments. By way of recovery of debenzolized oil, we get 95 per cent.; and in the first few weeks such percentages as 88, 90, 86·5. So that there is practically no loss in oil.

Mr. Bell: So you can keep using the oil again and again.

Mr. Bond: It has kept well up to now—that is, up to twenty times using. If it ceases to take up benzol or toluol, then I intend to put it through the carburetted water-gas plant.

Mr. Bell remarked that the loss in calorific value was about 40 B.Th.U., or 6 per cent. With respect to Mr. Pooley's paper, they were interested to know of the results that he had been good enough to indicate to the Association. He had, however, convinced most of them that they could not go in for washing their gas with green oil. Mr. Pooley stated that he got an average of 9 lbs. of benzene and 2·7 lbs. of toluene per ton of coal, which were extremely high figures. But he did not tell them how much he denuded his gas of its illuminating power, and what was the reduction of calorific value. He took it that what Mr. Bond suggested was that they should take out as much benzol and toluol as they could, and still give the consumers a gas that they, as gas suppliers, could fairly distribute—say, a gas coming somewhat below 12 candles.

Mr. Bond said he should advise that the reduction be done gradually. He did not think it would be good policy to reduce by 4 or 5 candles straight away. At the start, at Southport they reduced the illuminating power by 1 candle, and now they had reduced it by 2½ candles. Finally, he believed they would get down to about 10 or 11 candles; but they would go steadily at it. He did not intend, unless absolutely forced, to comply with the statutory regulation in this regard in the future. This was his position: His Corporation had spent a considerable sum of money over this process; and, of course, they could not recover the money now, because they were doing all they could to get the products that the Government required. Naturally, he should expect to make this good after the war. Therefore, he contended that if the consumer was satisfied with 12-candle power gas, and if they could show the consumer how to use it, then the proposition was a simple one—that was, to continue the supply of the 12-candle gas instead of 16-candle gas. [Laughter.]

Mr. Bell said that he agreed with Mr. Pooley that there was no money in the process he had brought before them. But they did not want to make money out of it during the war; they were quite willing to do all they could to give the Government as much benzol and toluol as possible—whether it paid the gas-works or not. That was a secondary matter; and they were all patriotic. They knew, too, that France required benzol very badly; and they must make what they could for this country's Allies. Mr. Pooley said that his gas was washed through a washer with green oil. Was that a Livesey washer?

Mr. Pooley: Yes.

Mr. Bell said extracting such a large quantity of benzene and toluene from the gas as Mr. Pooley had mentioned, the effect must be very drastic in respect of illuminating power and possibly calorific value. Mr. Pooley also pointed out that there would be some difficulty in getting green oil; and, so far as that went, there was some difficulty in getting American oil at the present time. The price of 6d. per gallon was not ruling now; it was something like 50 per cent. higher. He had a quotation at 8¾d. two or three days ago; but it was withdrawn that morning.

Mr. Samuel Glover (St. Helens) asked whether they might seek a further favour of Mr. Bond. Those who were thinking of applying such a process as this, would welcome an opportunity of spending a little time at the Southport Gas-Works in order to investigate it. Would Mr. Bond welcome deputations of engineers who desired to go further into the details?

Mr. Bond said he should be glad to receive any number of deputations to see the process. Also if any engineer would like

to send over his chemist, they would be pleased to let him have the use of the laboratory, and conduct a number of tests along with their own chemist.

Mr. GLOVER said that some of them would leave the meeting fully satisfied that they knew where to go for further details of the process. This system of washing with petroleum oil was very applicable to works where there was some sort of tar distilling or oil distilling plant in the first instance; but, in the case of the managers of works where there was no tar-distilling plant, they could put down some simple extension of the process, and the petroleum oil, or the green oil (when it could be obtained), could be easily and readily distilled on the works by means of this simple apparatus.

Mr. BOND said that any of the tar dehydrating or refining plants could be used. He thought they could go further, and, if they could not get the necessary plant at once, they could build-up a simple form of dehydrating plant for the purpose.

Mr. GLOVER said that this cleared up another point, that it did not depend upon having on the works a tar-distilling plant, seeing that a simple plant could be put down for the repeated re-distillations of the washing oil. Mr. Bond had also cleared up the point as to what would become of his washing oil when he got sick or tired of washing gas for benzol or anything else that he wanted to take out of it. The process was, Mr. Bond's remarks showed, very applicable to works with carburetted water-gas plant.

Mr. BOND: With regard to washing with green oil, Mr. Pooley's results varied somewhat (they depended upon the conditions under which the washing was done); but his success could be repeated by anyone who got some green oil, and used the very simple process to extract the benzol which was so much desired for the nation's use at the present time. Both processes were worth consideration in the present circumstances of the country.

Mr. GEORGE STEVENSON (Long Eaton) said he had been looking up the results of some tests that he had made, and which corroborated Mr. Pooley in one particular. Mr. Pooley said that, with his washing process, he obtained 2·7 lbs. of toluene per ton of coal. At Long Eaton, an experiment showed 2·96 lbs.; but after introducing the limestone process, this was increased to 3·84 lbs. The figures closely approximated Mr. Pooley's; and they showed what could be got if they were prepared to eliminate illuminating power entirely.

Mr. POOLEY: Was yours per ton of tar or per ton of coal?

Mr. STEVENSON: Per ton of coal.

Mr. GEORGE HELPS (Nuneaton) said he was very interested in the experiments these gentlemen had made. He was told that he was talking nonsense when, some three or four years ago, he spoke about getting down to a calorific value of about 300 B.Th.U., and no illuminating power. This work about which they had been hearing pointed to the fact that he was not then talking so much nonsense as he even then thought he was doing himself. [Laughter.] At that time Mr. Bond and some of their friends talked of 600 B.Th.U., and 18-candle gas; and now Mr. Bond was speaking of 10-candle power, and of 490 B.Th.U.

Mr. BOND: I should have got down before, had it not been for the statutory requirements.

Mr. HELPS: That is the road we are going to take; and when we get down to 300 B.Th.U. and no illuminating power, we shall be able to sell gas at such a low price that people can afford to use it.

Mr. C. H. CARDER (Oldbury), referring to Mr. Bond's proposal to dispose of the spent gas oil in his carburetted water-gas plant, asked what was the effect on the sulphur content of the gas oil. His carburetted water-gas purifiers were hardly large enough now for their work; and he did not want to overload them by adopting some process that would quite likely increase the sulphur content of the gas.

Mr. BOND replied that he had not tested the gas oil for sulphur; but he could readily have the test made, and would furnish Mr. Carder with the results in about a week's time—perhaps less.

Mr. SAMUEL GLOVER: The sulphur content would be proportionately variable with the length of time the gas oil lasted. It might be that there would not be any need to use the oil in the carburetted water-gas plant, and then there would be no question as to recovering the sulphur again.

Mr. THOMAS BERRIDGE (Leamington) said the matter that had frightened most of them in connection with these processes was the reduction of the illuminating power. They had already had, through working with the "C" process, a great deal of trouble in regard to illuminating power; and he had the additional difficulty of more naphthalene. He had all the apparatus Mr. Bond had referred to which he could put up quite easily; but while he claimed to be perfectly loyal, and anxious to do all he could for his country, he really did not think he dared do more than he was doing now—there would be such a big row all over the town. Owing to the lighting restrictions, and the early closing of the public houses, they had a reduction of about 20 per cent. in their output. It seemed to him the Government did not help them so much as they might do. They ought to pass an Act of Parliament, and give some assurance that they would protect the gas industry. Customers were being lost; and there was no doubt they were going over to the electric light, and it was a question whether they would get them back again. His illuminating power was down now to about 14 candles; if he reduced it to 12 candles, he believed it would practically half-ruin them.

Mr. BOND: A very neat pamphlet has been got out by the British Commercial Gas Association for distribution among consumers. You should distribute it in your district. It has had a good effect in Southport.

Mr. BERRIDGE said the consumers would not read it. If gas undertakings were compelled by law to do this work, then they would have to do it; and they would get a little more protection from the Government than they had at the present time. One was quite anxious to do all one possibly could; but there was need for more protection.

Mr. B. W. SMITH (Walsall) sympathized somewhat with what Mr. Berridge had just said. There was some fear that electricity undertakings would take advantage of this lowering of the illuminating power of the gas; and there were no means, except by the circulation of literature, to defend one's concern. The difficulty was to get people to read the literature. With regard to illuminating power; its reduction to a much lower point was all very well for those whose consumers used incandescent burners entirely. In his case, they had a large number of consumers in the leather trade who employed flat-flame burners. The Ministry of Munitions stated that those who had flat-flame burners ought to know better, and ought to use incandescent ones. He had done all he could to impress upon consumers the importance of the change—not only in view of money economy, but in view of the improvement of light. The difficulty was, with any interference with the illuminating conditions of the gas, to prevent customers going over to electricity. In reference to the matter of scrubbing as introduced by Mr. Bond, might he ask why he placed his washer first? His (Mr. Smith's) works were differently arranged. In his case, he used a Livesey washer for tar washing, he then used a pre-benzolized creosote washer for naphthalene, then he went on to a tar-washer to take out the tar, and then the gas went into a Holmes washer for ammonia. Where in this case would Mr. Bond place his scrubber?

Mr. BOND: The tar-washing process in my case takes place after the condensers in a Livesey washer; then the gas goes through a Pelouze-Audouin tar-extractor, into a Holmes washer (which removes the whole of the ammonia), and immediately after comes the scrubber to which I have referred.

Mr. SMITH: That is next to the inlet of the purifiers.

Mr. BOND: Yes. You mentioned naphthalene. The oil takes up a considerable quantity of naphthalene; and we have not, since using this process, had more than about 5 grains of naphthalene per 100 cubic feet at the inlet of the purifiers. Therefore a reduction has taken place in the naphthalene content of the gas at the outlet of the governors.

Mr. SMITH: Through absorption by the oil; so that you increase the naphthalene content of the oil.

Mr. BOND: It is increased.

Mr. SMITH: What are you going to do with the naphthalene, seeing you dilute your oil with that quantity of naphthalene?

Mr. BOND: It comes over with the distillate. We then sell the distillate as crude benzol; and the tar distillers deal with it afterwards. We considered erecting a benzol-refining plant, but found it was not worth while for the amount which could be recovered.

Mr. SMITH: The process would mean installing a new washer.

Mr. BOND: Perhaps you would have enough washing power to spare a washer—at any rate, in the summer months.

Mr. SMITH: We could perhaps in one section.

Mr. E. W. SMITH (Birmingham) said he had been intensely interested in hearing the description of the two processes for crude benzol extraction. Perhaps a reference to some of the results obtained on the coal-test works, and also on the complete washing plant at Nechells, might prove of interest to the members. When the plant at Nechells was first started up, American gas oil was used as the wash oil. This was changed to creosote, largely owing to the toluol produced containing too high a percentage of paraffins. This objection did not hold for benzol washing. Mr. Bond had given them some very satisfactory figures for the recovery of crude benzol by means of gas oil. Did these quantities contain any wash oil? In their case, they found that the crude benzol contained as much as 20 per cent. of wash oil; but the temperature of distillation was 120° C. with steam, as against Mr. Bond's figure of 110° C. Mr. Bond would be interested to hear that the creosote initially contained over 30 per cent. of naphthalene. When taken out of circulation at the end of five months, it contained 5 per cent.; the creosote having been separated in the cooling tanks and sold. This creosote after four months acted quite satisfactorily, although it had been through the stills over 360 times. At the point of washing, there was no tar in the gas. The crude benzol contained about 8 per cent. of spirit which distilled over before the benzene. This was termed "foreshots" or "pre-benzol." It contained about 1·5 per cent. of sulphur, and was returned to the gas as an enricher. On the coal-test works they had had a plant running very similar to that described by Mr. Bond. It consisted of three towers filled with hurdles, and four 400-gallon tanks, each filled with wash oil. Each tower and one tank worked separately from the rest—the wash oil returning to the same tank. The three towers worked for the gas in series, and when the oil in the first (gas) tower reached 5 per cent. saturation of crude benzol, the tank of oil was taken out of circulation for distillation, and the oil in the remaining tanks moved one tank—or tower—forward. The cooled debenzolized oil was then used in the third tower. This process was continuous and entirely successful. In connection with these tests he tried using a Holmes washer, and, as each bay was really a separate washer, oil was hourly extracted from each bay. It was found that this oil became saturated—under their conditions

of temperature and gas concentration—when the crude benzol content reached between 5 and 6 per cent. On continuing the washing in all the bays, it was noted that the crude benzol in the first saturated bay consisted of a large proportion of benzene and smaller proportions of toluene and xylene. On further use, the benzol was displaced by toluene, &c., until absorbed in subsequent bays. By this means, by adding 5 per cent. of benzol to the wash oil, it was possible to completely wash-out the toluene, which displaced benzene, and the quality of the gas remained approximately the same. This work threw some light on Mr. Bond's point that, after a certain stage was reached in continued washing with the same oil—without distillation—the wash oil appeared to lose benzene.

Mr. BELL proposed a hearty vote of thanks to Mr. Bond and Mr. Pooley for introducing these particularly interesting topics for discussion.

Mr. BERRIDGE seconded the motion, which was cordially passed.

Mr. BOND thanked the members most sincerely for their vote. It had been a great pleasure to him to meet the members of the Midland Association once more. With regard to the questions that had been put to him, he thought he had covered most of them; but if any member wished for further particulars, and would write to him, he would be pleased to give him all the information in his power.

Mr. POOLEY said he should also like to thank the members for their kind vote. There was only one question he had not answered. That was the one Mr. Bell addressed to him as to the illuminating power and calorific value. In his opening remarks, he stated that they pulled-up the illuminating and calorific power by means of the water-gas plant, and by lessening the make per ton in the second section at the Aylestone Road works.

TOLUOL AND THE LIMESTONE PROCESS.

By GEORGE STEVENSON, of Long Eaton.

[A Paper presented to the Midland Association of Gas Engineers and Managers, March 23.]

At the request of our President, the author has pleasure in submitting a short note of experiments which have been made with the above process at his works during the past eight months.

There is nothing new in the use of a mixture of lime and coal for carbonization; for so long ago as 1882 Cooper was granted a patent which claimed by the use of lime:

(1) An increased yield of ammonia from the coal.
(2) An increased yield of gas or tar.
(3) A reduction in the impurities.
(4) An improved coke.

No claim was made specially for an increase in the hydrocarbon content of the gas. Probably, the purification value of the process was the great attraction, as at that time the sulphur clauses were rigidly enforced, and gas undertakings were ready to investigate any new method which gave promise of help in this connection. The main practical difficulty, however, was the absence of an arrangement for the thorough mixture with the coal, as the powdery nature of the quicklime caused much trouble. In many cases, where no machinery was used, and consequently the coal was not crushed, it was not possible to effect the desired mixture.

On the whole, the process seemed to fall away until Mr. R. O. Paterson (an esteemed Past-President of the Association) devised and patented a method of mixing which overcame all the difficulties. Mr. James Paterson, M.A., favoured the gas industry with a very interesting and complete account of the Cheltenham experiences, in a paper he read before the Southern Association of Gas Managers on Nov. 9, 1911. I refer those interested to this paper and the useful discussion which followed.

After the repeal of the sulphur clauses in the South Metropolitan Gas Company's Act, and the consequent general acceptance of the principle of freeing gas undertakings from obligations of this nature, the main objects of the liming process naturally aroused less interest; although the advent of keener commercial conditions compelled some of the most far-sighted undertakings to voluntarily reduce the sulphur content of their gas. It must be admitted that these pioneers were right, that their policy is abundantly justified, and all gas managers are agreed as to its great importance.

EXPERIENCES AT LONG EATON.

Having thus digressed on historical grounds, I come to our own experiences. In the summer of last year, when the "C" process was inaugurated, many of us began to test for our own results; and not a few of us were surprised to find how little was known about toluene by coal-gas engineers. At our own works, we were disappointed to find with our ordinary system of working a very small amount of toluene in the tar. It was realized that this toluene content of tar would vary in each works according to the class of coal used, the temperature of carbonization, the efficiency of washing, &c.

The process as now under review, and comprised in patents No. 18,744 of 1911, &c. [see "JOURNAL" for April 16, 1912], was brought to our notice; and, though primarily intended for coke-ovens, it was resolved to try it, rather than modify our existing working. One object only was sought—viz., an increase in the recoverable hydrocarbons in the gas and tar.

The process, which is designed specially for low-grade semi-coking coals, consists in the admixture of a definite percentage (according to the analysis of the ash in the coal) of finely-ground limestone; and for effective working the coal must be crushed, and the mixing constant and regular in quantity.

It is claimed by the patentees that the action of limestone is entirely different from that of burnt lime, in that "the limestone, when intimately mixed with coal rich in hydrocarbons and with a high oxygen content, commences to decompose at a temperature lower than that of the resinous and other matters contained in the coal, and that the actions taking place slightly retard the evolution of the gases generally given off so freely with low-grade coals, and this allows of their becoming more stable."

The author does not necessarily subscribe to the theoretical claims made for the process, and in these strenuous times, when there is perhaps far too much talking, practical results are of more consequence.

METHODS OF MIXING THE LIMESTONE.

Our first efforts were directed to secure admixture by the construction of a receiving hopper, in which was fixed a rake-mixer, driven by a worm-gear from the main shaft of the De Brouwer projector; the bottom exit for the limestone being effected through a horizontal sliding door connected with the lever operating the coal from the hoppers. A subsequent improvement was the introduction of a 1 H.P. motor for arriving at the required speed. By this means, a regular and definite quantity of material was introduced with the coal into the grooved pulley of the projector.

However, the gritty nature of the limestone gave constant trouble; and it was decided to feed the required quantity of material evenly on the top of the coal-waggons in the siding—the waggons, having bottom doors, emptying into a breaker, and the coal and limestone being elevated into overhead bunkers in the usual way. Experience has proved that this simple method gives perfect admixture.

Important points to note are that the coal must be small, and preferably densely charged; so that when mixed with the limestone a good surface contact may be ensured.

The limestone in our case is pure mountain quality—practically pure calcium carbonate; though a limestone containing a definite percentage of magnesia may be required in other cases for accelerating the evolution of vapours, instead of retarding them.

The sizing of the limestone is all-important. If this is too large, the coke is badly pitted.

Various criticisms (many from those who have no practical experience) have been made against the process. The chief of these are:

(1) That the limestone is an inert substance, and has no chemical or physical action on carbonization.
(2) That the quality of the coke is adversely affected.
(3) An alleged increase in stopped ascension pipes.
(4) Excessive clinker in the furnaces.

It is not the intention of the author to contest the theory of the first point, but that some action takes place is proved by the following tests:

Date, 1915-16.	Number of Test.	Description.	Pounds per Ton of Coal.	
			Toluene.	Benzene.
Sept. 3 . . .	1	Untreated tar	0·096	—
,, 3 . . .	2	Washed tar	0 50	—
,, 17 . . .	3	Limestone washed tar	0·73	—
Nov. 29 . . .	4	Washed tar	0·48	1·26
Jan. 6 . . .	5	Limestone washed tar	1 24	2·49

The tar is apparently completely altered in character—being more oily; and if there is no beneficial action, it may be asked how otherwise these improved results have been obtained?

In this connection attention is directed to Dr. Lessing's lecture on "Catalysis" [see "JOURNAL" Sept. 8, 1914], and articles in the "JOURNAL" and "Gas World," and a useful book on "Catalysis," by E. Jobling, published by Messrs. J. & A. Churchill.

As to the quality of the coke, it may be remarked that one of the prime objects of the process is the improvement of the coke, which from these coals with ordinary carbonization is generally soft and friable. In our experience the coke is greatly improved and is being freely used for the most exacting purposes.

We have an almost complete immunity from stopped pipes.

The furnace clinker, admittedly, is harder, but not seriously so.

As arranged with our President we have just completed two practical tests—viz., one week's total carbonizing with and without limestone admixture. The results are given in Appendix A; and the following are observations thereon.

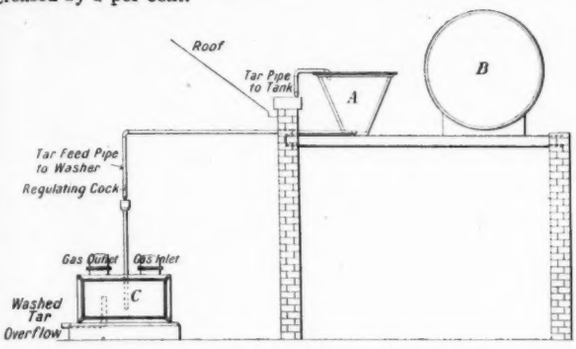
EFFECT ON THE GAS.

There was a small increase in both the quantity and calorific value; but no tests were taken of the lighting power. The flat-flame burners were, however, distinctly better with the limed gas; and the analysis for olefines, &c., corroborates this. The naphthalene was reduced; and we were free from complaints except from the gas without limestone when stoppages occurred in the

district. The most marked advantage was the great reduction in the total sulphur content of the gas. These sulphur tests were checked and rechecked; and, bearing in mind the fact that only one ascension pipe is used, the result may be described as remarkable, and perhaps worth the whole of the trouble and total cost. The claim that the gas would be given off more regularly was not sustained, although laboratory tests were quite favourable to this theory.

Effect on the Coke.

Samples are submitted of the limed coke. There was a small reduction in the quantity of breeze; and the ash content was increased by 2 per cent.



A. Feed Tank for Tar to the Livesey Washer—450 Gallons Capacity.
B. Overhead Liquor Tank to Sulphate Plant. C. Livesey Washer.

Arrangement for the "C" Washing Process at Long Eaton.

Effect on the Tar.

As expected when changing over to liming, the tar was found to be much thinner and more oily. A slightly increased yield was noted. The toluene content was greatly increased; and it is only fair to refer to the great difference in atmospheric conditions prevailing during the two weeks. In the first week (without limestone) the temperature was exceedingly low, and the result bears testimony to the efficiency of the washing arrangements.

Cost of Working.

	£	s.	d.
7 tons 4 cwt. limestone at 10s.	3	12	0
Labour, mixing	1	5	2
Royalty at ½d. per ton of coal	0	10	2
Cost per ton of coal, 5·27d., or 0·45d. per 1000 cubic feet	£5	7	4

On the credit side is 280 cubic feet of gas per ton of coal at 1s. 6d. per 1000 cubic feet, £5 2s. 8d.

Other items not assessed in money are: Great reduction of impurities; improvement of coke; reduction of breeze; freedom from naphthalene troubles; increased tar production; increased tar value. The net result of this test proved that the increased quantity of gas alone paid the whole of the cost.

Conclusion.

In conclusion, it may fairly be stated that the claims of increased hydrocarbons in the gas and tar, by means of the limestone process, are generally sustained, and excellent results have been attained and recorded. The many and various changing phases of carbonization and the complexity of all tars add to the difficulty of any certainty in the ultimate results from coal-gas works, although further experience may establish some definite lines of practice which may lead to final general success.

Appendix A.

Carbonizing Tests at the Long Eaton Gas-Works, March, 1916—New Hucknall and Bentinck Coal and Pinxton Nuts.

—	March 1 to 8 Without Limestone ("C" Washing).	March 10 to 17 With Limestone ("C" Washing).
Number of charges	446	446
Coal carbonized	247 tons 3 cwt.	244 tons 10 cwt.
,, per 12-hour charge	11·08 cwt.	10·96 cwt.
Gas made	2,924,000 cubic feet	2,963,000 cubic feet
,, per ton of coal	11,838 cubic feet	12,118 cubic feet
Average gross calorific value	531 B.Th.U.	536 B.Th.U.
Calorific value per ton of coal	6,285,978 B.Th.U.	6,495,574 B.Th.U.
Average composition of gas—		
Carbon dioxide	2·2 per cent.	3·1 per cent.
Olefines	3·5 ,,	4·6 ,,
Nitrifiable compounds	0·3 ,,	1·3 ,,
Oxygen	0·7 ,,	0·6 ,,
Carbon monoxide	8·9 ,,	9·6 ,,
Sulphur	25 grains per 100 c. ft.	13·9 grains per 100 c. ft.
Naphthalene	7·6 ,, ,,	6·6 ,, ,,
Coke made	152 t. 1 c. 3 q.	145 t. 15 c. 2 q.
Breeze made	41 t. 1 c.	36 t. 2 c. 2 q.
Coke saleable	115 t. 15 c. 2 q.	114 t. 3 c.
Coke saleable per ton of coal	9·37 cwt.	9·33 cwt.
Coke used in furnaces	36 t. 6 c. 1 q.	31 t. 12 c. 2 q.
Coke used in furnaces per 100 lbs. of coal carbonized	14·7 lbs.	12·93 lbs.
Breeze used in furnaces	9 t. 16 c.	7 t. 17 c. 3 q.
Breeze used in furnaces per 100 lbs. of coal carbonized	3·96 lbs.	3·22 lbs.
Breeze used for boilers	31 t. 5 c.	28 t. 4 c. 3 q.
Total coke made—percentage on coal carbonized	61·53 per cent.	59·62 per cent.
Total breeze made—percentage on coal carbonized	16·61 ,,	14·77 ,,
Total residuum	78·14 ,,	74·39 ,,
Quantity of tar made	2670 gallons	2695 gallons
Quantity of tar made per ton of coal	10·8 gallons	11·02 gallons
Specific gravity	1·190	1·184
Water	3·65 per cent.	3·72 per cent.
Distillates 0° to 145° C.	4·84 ,,	5·51 ,,
,, 145° to 170° C.	0·97 ,,	1·81 ,,
Toluene per ton of coal	0·941 lb.	1·409 lbs.
Benzene per ton of coal	1·563 lbs.	2·459 lbs.
Average temperature of tar and washed gas	40° Fahr.	50° Fahr.

Appendix B.

Coal used: New Hucknall and Bentinck coal and Pinxton nuts. All coal, coke, and breeze carefully weighed over weighbridge.

Tar separately collected in a special tank. Tar for washing gases separately measured and sampled.

Rate of washing: As made.

Calorific value of gas determined by average of systematic and constant tests day and night. Recording calorimeters on "make" and "town" throughout test.

Retorts 23 inches by 16 inches by 20 feet, segmental section, regenerator fired, and filled by De Brouwer projector.

Average temperature in retort, 1180° C.

REINFORCED CONCRETE FOR WATER-WORKS.

It was pointed out by Mr. Charles F. Marsh, M.Inst.C.E., in a paper which he read before the Concrete Institute, that in the construction of works specially required for the purpose of the conveyance and storage of water reinforced concrete can be usefully employed for many purposes. The chief uses for this material are the construction of dams for impounding water, of aqueducts and pipes for its conveyance, and reservoirs and tanks for its storage. There are also many works of an incidental nature for which it may be employed, among which are retaining walls, bridges, slope coverings, buildings, fencing, and sundry other structures of various descriptions essential for the completion of any large system of water supply.

He remarked that the concrete used for structures which must resist the pressure of water should be richer in cement than that employed for the generality of structures. For reservoirs, tanks, and dams, where there is sufficient thickness, the concrete should be mixed in the proportions of 1 : 1½ to 3, or 810 lbs. of cement to 13½ cubic feet of sand and 27 cubic feet of broken stone or shingle, which mixture is sufficiently water-tight for any but very considerable heads. But for pipes and structures of small thickness (say less than 3 inches), a mortar mixed in the proportions of 1 to 1½, or 1620 lbs. of cement to 27 cubic feet of sand, should be used.

For pipes under pressures exceeding about 40 feet some special lining should be used. For any structure which has to resist the percolation of liquids, it is advisable to mix a waterproofing compound with the concrete, or to otherwise provide against leakage by the use of a soap and alum wash, paraffin wax, or other suitable protective coating. For increasing the imperviousness of concrete or mortar, ordinary hydrated lime has been used very successfully, and appears just as effective as any of the patent compounds on the market. It can be used in proportions up to 10 per cent. of the weight of cement without injuriously affecting the strength of the mixture; but 5 per cent. is sufficient for any ordinary purpose.

The concrete should always be kept damp for some time after moulding, depending on the richness of the mixture. The period in the case of a 1 to 1½ : 3 mixture should be about two weeks. In structures of considerable length, which may be alternately wet and dry, and are exposed to variations of temperature, it is advisable to provide against cracking, which is almost certain to occur. Such structures should have specially constructed contraction joints not more than 30 feet apart; leakage being prevented at the joints by the insertion of sheet lead or copper baffles extending well into the concrete on each side of the joint, and bent over at the extremities to form a good key. In the construction of all structures to resist the pressure of liquids, special care is necessary to provide adequate reinforcement against shrinkage due to the setting of the concrete, fall of temperature, and excessive dryness.

When reinforced concrete is employed for the construction of dams, they are usually of a hollow form of construction, having up-stream and down-stream slabs supported on cross walls carried upon a foundation slab. From the foundation slab, a core wall must be carried down under the bottom of the up-stream slab, and extended well into a water-tight stratum. The provision of an adequate cut-off wall is most essential, as some of the dams already

constructed of this material have failed owing to the neglect of this precaution. The up-stream slab is generally constructed with a flat slope not steeper than 1 to 1, since the flatter the slope the more uniform is the pressure on the base.

The base slab of a hollow dam is generally formed with holes to allow any water which may gain access under the dam free vent, and obviate any tendency to lift. The water percolating through the base slab is discharged under the bottom of the down-stream slab to the stream below the dam. The crest of the dam is formed of such shape as will accommodate the flow of the greatest height of flood which will be allowed to pass over without the formation of a vacuum under the overfall. The down-stream slab is generally constructed of a considerably flatter slope than that usual for solid masonry dams; and the water is consequently conducted to the stream below the dam with less velocity, and with a more even flow. This slab frequently terminates before reaching the base of the dam, allowing free access for the water to and from the interior, or sufficient holes are left at its base to effect the same object. The cross walls or buttresses are stiffened by longitudinal beams, and may be formed with openings to economize material and give means of access. There is usually a passage-way through the dam from end to end, and frequently several at various depths. The gearing for the outlet and scour valves may be actuated from these passage-ways. Dams, when of small height, are sometimes constructed without a down-stream slab.

Perhaps, said the author, one of the most economical uses of reinforced concrete is for constructing elevated tanks. A reinforced concrete tank can be constructed at a cost of from 40 to 50 per cent. that of a tank formed of riveted steel plates; and they will in general be less expensive than tanks of pressed steel or cast-iron plates. When designing circular reinforced concrete tanks, it is, he thinks, advisable to limit the working resistance of the steel to 12,000 lbs. per square inch, since, though the tensile resistance of the concrete is neglected, the elongation of the steel bars must induce elongation in the concrete; and a higher stress in the steel will in all probability cause the concrete to crack. It is also advisable to insert two series of circular rings in the walls of the tank, one near each surface, in place of one series at the centre of the thickness. Some typical examples of concrete tanks were described and illustrated in the paper.

In the construction of reservoirs that are entirely or partly in the ground, Mr. Marsh said the question as to the economy or otherwise resulting from the use of reinforced concrete should receive careful consideration before its employment is decided upon. The method of design will also require much attention. In many cases it is not economical to use reinforced concrete for the walls or floor; but it is almost universally an economical material for roof construction. If a considerable portion of the depth is below ground, the form of retaining wall construction, with a bottom slab at the back tied to the front slab by ribs, is not an economical form, as the excavations have to be considerably enlarged to accommodate the bottom slab. A wall designed as a cantilever, supported from the floor of the reservoir, will reduce the excavation; but great care is necessary to provide ample support at the bottom to prevent failure between the base of the wall and the floor when the reservoir is empty. If the reservoir is covered, and the covering can be constructed before excessive loading is brought upon the walls, the roof beams and similar beams formed in the floor can be constructed to support beams along the top and bottom of the wall, which, in their turn, support the ends of vertical beams between which the walls of the reservoir can be constructed as slabs with horizontal reinforcements. The covering usually adopted for reservoirs is of the beam and slab type, similar to ordinary floors, and supported by columns; but small circular reservoirs may be covered with a flat dome, in a similar manner to that frequently employed for elevated tanks. Open aqueducts built almost entirely above ground-level, and those for carrying water over valleys, may, with economy, be constructed of reinforced concrete; but for those constructed mainly below the ground-level, this material will not be so economical, for the same reason as in the case of reservoirs.

Pipes under small heads—say, up to about 40 feet—may be constructed of reinforced concrete without any special impervious material being embedded in the thickness. For heads over about 40 feet, some special impervious layer will be necessary. The well-known Bonna pipe is a good example of this type of construction. The impervious layer is formed by a thin sheet-steel tube, with longitudinal welds formed by the oxy-acytelene or electric process. This tube is embedded in the thickness of the concrete, with the reinforcement outside for smaller heads, and inside and outside for greater heads. Reinforced concrete pipes when of convenient diameter are moulded vertically. Photographs were shown of the moulding operations for the 42-inch Bonna pipes for the Leeds Water-Works, for the conveyance of water from one of the reservoirs to the Westwood filters, under a head of about 50 feet. Pipes up to about 4 feet diameter are moulded in advance, and the joints formed with a reinforced concrete collar. For low pressures, the collars are simply run with cement mortar; but for high pressures the joint is made with a steel corrugated ring, into which are driven lead pipes filled with gasket. The collar is then threaded over the joint and run in the usual manner. Large pipes must be formed *in situ*; and in this case great care must be taken to form a good connection when recommencing the work after a stoppage. In designing pipes, the stress in the steel should be limited to 12,000 lbs. per square inch, and it is advisable to form the reinforcement with outer and inner spirals when the pipes are of large diameter. The thickness of concrete for pipes may be approximately 1 inch per foot of diameter, with a minimum of 1½ inches.

DISCUSSION.

The PRESIDENT (Professor Henry Adams) said that some information as to the amount of reinforcement in various cases would be useful; and among the important points for consideration were the use of materials to increase the imperviousness of concrete; and the question of the strength when such materials were used.

Mr. W. B. BUTLER, speaking with regard to waterproofing, asked what proportion of hydrated lime could be used for adding imperviousness without injuriously affecting the strength.

Mr. MARSH replied 10 per cent.—a figure which was arrived at by experiments carried out in America.

Mr. BUTLER said there were a great many preparations on the market for rendering concrete waterproof; but it was doubtful if they were of much use. He was very much of the opinion that if the concrete were properly mixed and graded no addition was necessary.

Mr. H. J. TINGLE asked as to the method for preventing cracks in aqueducts, due to temperature variations on the outside.

Mr. M. NOEL RIDLEY felt great timidity in relying solely on the concrete, without some admixture to make it waterproof.

Mr. S. BYLANDER asked whether experience had shown any difference in effect when the reinforcement was placed wide apart, compared with having the reinforcement close together.

Mr. W. J. LEVERTON suggested that the mixture of hydrated lime for waterproofing purposes would considerably increase the length of time required for setting, and would also involve the centering being left on longer.

Mr. H. J. HARDING expressed the opinion that the waterproof qualities of concrete depended to a great extent on the amount of water used in mixing. Too much water tended to make the concrete porous.

Mr. MARSH, in reply, said he saw no reason why hydrated lime or other substance should not be added to ensure waterproofness, though an absolutely well mixed and proportioned concrete should be sufficiently water-tight for ordinary purposes. It would hardly be economical to use reinforced concrete for wells, because the walls were entirely in compression. As to the distance between the reinforcing rods, he favoured putting them close together and keeping them small, rather than having big rods far apart. The effect of hydrated lime on the setting-time was to slightly increase it, but not sufficiently to make any great difference.

Trade Conditions after the War.

On the invitation of the Council for the Organization of British Engineering Industry, a meeting of engineers took place in Manchester some days ago, to hear an address by Mr. T. C. Elder on the "Engineering Industry and Public Policy." In this, the need was urged of a heroic national effort of re-organization, or else, "even with victory in the field, we should pass on to social and industrial disaster." The output capacity of British engineering had, said the author, been increased during the war by an amount estimated at from 30 to 50 per cent. Extensions had also taken place in Germany and Austria, as well as in various other countries. The character of the equipment of engineering factories, too, had been considerably altered. It was essential to our future prosperity that Britain should be pre-eminent in the engineering and chemical industries. As to the Government, all indications suggested that we should reach peace totally unprepared, and "enter upon another desperate scramble to make up for lost time with wrong men and wrong measures, foolish amateur experiments, and much money thrown away." As to the engineering industry, this, he declared, would fall far short of what was possible if it did not organize a general Association powerful enough to exert collective influence in all foreign markets, to offer authoritative counsel to the Government, to stimulate scientific research, and to bring it into closer communication with industrial progress. There was some discussion; and the feeling of the meeting was reflected by the unanimous passing of a resolution, on the proposition of Mr. Fred. J. West (President of the Manchester District Engineering Trades Employers' Association), who pleaded for the maintenance of a happy relationship between employers and workmen, and also urged that firms should specialize more than they had done in the past. The resolution was to the effect that, in view of the greatly enhanced capacity of the British engineering industry, now engaged on munition work, and of the severe competition to be expected after the war, the meeting was of opinion that the organization of the industry from within should immediately be undertaken. As noted elsewhere, Committees have been nominated by the Board of Trade to consider the position of certain industries (among them engineering) after the war.

Fuel Economy and the Utilization of Coal.—In response to requests that were addressed to him from different quarters, Professor William A. Bone, D.Sc., Ph.D., F.R.S., of the Imperial College of Science and Technology, has thoroughly revised the series of three lectures on "Fuel Economy and the Utilization of Coal" lately delivered by him at the Royal Institution. They have been printed together in pamphlet form, and are now on sale at the "JOURNAL" Office.

COKE FUEL FOR STEAM-BOILERS.

By E. W. L. Nicol,

Engineer and Fuel Expert to the London Coke Committee.

[A Paper read before the London and Southern District Junior Gas Association, March 24.]

In presenting the following paper, it is proposed to consider the influence of fuel characteristics on the thermal efficiency of steam generating plant, and their relation to the commercial value of steam-raising fuels. A study of the relative commercial values of industrial solid fuels in general use in the London district will show that this subject is one of considerable immediate interest to the gas industry generally, and particularly to the branch represented by this section of the Junior Gas Association.

It will be seen that the price which in normal circumstances the steam user has to pay for coal is not, except in certain cases, based upon the gross calorific value, but upon the net evaporative value realized when it is fired under the conditions usually obtaining in steam-boilers. In these conditions are included those imposed by local authorities as to the emission of smoke. The advent of the mechanical coking stoker, and the somewhat short-sighted policy of its general adoption in electricity supply and other power works, has created a demand for coal slack which threatens to exceed the available supplies, with the inevitable result that the price, which has about doubled during the past ten or fifteen years, is now in excess of that paid for better quality coal by steam users who are not restricted in their range of choice by stoking machinery which necessitates the use of a more or less uniform class of bituminous coal slack.

Incidentally, the demand thus created has resulted in a desire to purchase such fuel on a sliding-scale principle, based upon the gross calorific value with certain limitations as to moisture and ash content; an equivalent weight of coal usually being allowed for according to the percentage variation from the agreed standard values. So far as the writer is aware, the use of this basis of sale, which provides merely a useful means of comparison of gross calorific values, has been adopted chiefly by large users of coal slack; but it has recently been suggested that the same principle should be applied in the sale and purchase of all solid steam-raising fuels. Applied equally to all such fuels without regard to characteristics which determine the degree of efficiency attainable in using them, this principle would be, in the writer's opinion, quite unacceptable—more especially from the fuel manufacturers' or sellers' point of view.

Equitable Basis of Sale.

An equitable basis of sale and purchase would have regard to the relative proportion of fixed carbon and volatile hydrocarbons contained in the fuel. Without due appreciation of these factors, adequate protection to the buyer or the seller cannot be ensured. The difficulty experienced in burning coal under steam-boilers smokelessly and efficiently is in direct proportion to its volatile content; and it is chiefly this factor which automatically forms the present basis of appraisement. While many steam users prefer to employ coal slack because of the greater heat value obtainable per unit of cost, others prefer large steam or the more expensive anthracitic Welsh coals. But the practical results realized in cost of evaporation with the various grades available at normal prices show only a small margin in favour of any particular class after due allowance has been made for maintenance of mechanical stokers or other charges incidental to their use. The smokeless characteristic of Welsh coal, due to the relatively high proportion of fixed carbon, renders its use in certain localities desirable; but it would be wrong to assume that for this reason alone Welsh coal commands the higher market value, which is relatively out of all proportion to its superior calorific value. Many shrewd buyers use Welsh coal, although so-called bituminous coal of about equal calorific value may be obtained at 20 per cent. less cost. Therefore, to reconcile the South Wales colliery owner to the price accepted by his *confrères* of the Midlands on the basis suggested would be a matter of some delicacy; but, on the other hand, the gas companies may reasonably expect to realize for coke having at least an equal proportion of fixed carbon and a relatively higher efficiency, a price which bears a closer relation to that obtained for Welsh coal. Compared with Welsh coal, the only additional charge incidental to the use of coke which can reasonably be debited against the latter is the cost of blowing, when this is necessary to maintain an equivalent rate of combustion.

Need for Inexpensive Appliances.

In marketing their gaseous combustible products, gas and other fuel companies have good reason to appreciate the advent and development of inexpensive appliances for burning gas efficiently at high temperatures. The relatively high cost of the forced-draught apparatus necessary to burn coke at a high temperature is largely responsible for the comparatively limited market and poor prices realized in the past for their solid fuels; and continued reliance upon private enterprise in developing efficient and inexpensive apparatus for this purpose will not, in the writer's opinion, tend towards the removal of this obstacle.

The immense capital sunk in steam-generating plant, presumably designed and rated on a coal-fuel basis, renders it imperative that any coke-burning attachment must conform to existing conditions, and to readily commend itself to a steam user it must be inexpensive and capable of maintaining or increasing the steaming capacity of his boilers; while it must, if necessary, be suitable for attachment to a boiler-furnace without any, or any serious, interruption to its working. That these conditions can generally be ensured has already been largely shown. But a great deal still remains to be accomplished in this and other directions; and it is to be hoped that sustained effort and financial support will be organized in experimental work in due proportion to the benefits that would accrue. A modest yearly subscription of (say) 1s. per 100 tons carbonized by the gas and coke-oven companies interested would form the nucleus of a fund to provide the necessary means and incentive to inventors in this direction. Without effort and incentive of this description the use of surplus oven and gas coke may continue to be more or less limited to low-temperature apparatus.

State Control.

The developments in State control of fuel supplies and combustion which we are led to anticipate, if exercised on advisory lines with a view to securing national economy in fuel in the widest sense, the writer thinks would be to many steam users a welcome innovation. Such an innovation can only re-act to the benefit of industry in general and the gas industry in particular, by extending the use of the most economical of all fuels from a national standpoint—namely, gas and coke—for power and other industrial purposes. Acting on the dictum "every man to his trade," it would be well for the gas industry to be prepared, in its capacity of the leading fuel authority, with a solution for every fuel problem likely to arise.

A Necessary Preliminary Step.

So far, no very definite indication has been made of the lines upon which control would be exercised; but if one may be permitted to make a suggestion, a useful preliminary step in this direction would be the registration of the effective grate areas of all steam-generating plant, together with the maximum and average hourly rates of fuel combustion. Armed with this information, the responsible authority, vested with the necessary power, would be enabled to act with some degree of precision in so allocating supplies of gaseous and solid fuels that a state of efficient and practically smokeless combustion—at least, so far as steam plant is concerned—would eventually be brought about with a minimum of expenditure on new plant.

The Smoke Problem.

Of all fuel problems, that generally known as the smoke problem is perhaps the most acute. Few steam users have good grounds for complaint of neglect in this connection. Efforts of local governing authorities in this direction have in the past often degenerated into mere chimney watching. The credit side of their account with the nation is no doubt substantial; but who can appraise the national loss and the loss to industry incidental to their activities and arbitrary regulations? A smokeless coal-fired boiler chimney does not necessarily imply efficient combustion. In the writer's experience, such conditions more often involve both reduced efficiency of combustion and, what is probably of equal importance, reduced capacity, chiefly due to the admission of large quantities of excess air to the boiler-furnace or beyond it.

The rigid imposition of the penalties involved in the breach of these regulations is, in many districts, often rendered impracticable by the failure of the fining authority, collectively or individually, to comply with their own regulations. The spectacle of a steam-using department of a municipal body being summoned for smoke emission by a local suburban authority is an instance in point. But the most serious aspect of the problem is the case of the factory, the output of which is limited to the steaming capacity of its boilers under the onerous conditions imposed, and the unavoidable waste of fuel involved in a conscientious endeavour to comply with the regulations.

The lack of competent advisory control is shown in the following example of the operation of these regulations, which is typical of others within the writer's knowledge and may be described to illustrate this point. The weekly bituminous coal consumption of a certain Lancashire type boiler having a well-watched chimney was said to be 27½ tons. During a 22 months' "trial" of coke fuel of considerably lower calorific value, but fired on rational lines, the weekly deliveries have averaged under 23 tons, at 15 to 20 per cent. less cost per ton. The necessary forced-draught apparatus, supplied by the London Coke Committee, and fitted to the boiler on a free trial basis by the gas company, has been purchased outright for £12 12s. by the user, who has expressed himself as being "well satisfied." In this case, at least, the user does not appear to have been misled by interested advice. The present price of this apparatus—£6 6s. per furnace equipment—is a "war" one, and should not be regarded as final.

The true significance of this picture will be appreciated by gas engineers and others who have experienced sudden demands for coke during periods of scarcity of steam coal and an equally sudden falling off of such demands with a return to normal conditions. Introduced on proper lines, with methods and apparatus which ensure the best results being obtained, coke fuel has, in the writer's experience, only to be maintained at a price which shows a reasonable financial advantage to the user in order to secure favour. Moreover, a coke user provided with the apparatus indicated—which, unlike a chimney shaft, has a considerable margin

of elasticity in capacity—is less critical in the matter of small and unavoidable variations in quality. Also, the simultaneous introduction of forced draught, which carries with it many practical and economic advantages when compared with natural chimney draught, always tells in favour of coke. Equipped with this apparatus, however, a user has a wide range of fuels from which to choose; and instead of being confined to competition with smokeless coals, coke will, in these circumstances, be made to compete with cheaper and lower class coals. For this reason, therefore, adequate protection should be secured for all coke-burning apparatus, which, unlike gas appliances, is equally suitable for use with competing fuels; and the question of sale outright to the users should have serious consideration.

Mechanical Stoking.

The mechanical stoking of gas coke offers considerably more difficulty than is usually met with in stoking bituminous coal mechanically. But important progress has been made in this direction by a few of the leading makers who have specialized in this line—particularly for externally-fired or water-tube boilers of large capacity. Adapted for internally-fired boilers there are the various types of sprinkler stokers. These, and the larger-capacity travelling-grate type of stoker referred to above, are now available where the quantity of fuel consumed necessitates both mechanical stoking and continuous cleaning. These appliances emphasize the disadvantages of the ordinary spasmodic hand firing system with the necessary periodical interruptions for the laborious removal of accumulated refuse. Comparatively small steam plants, which do not warrant the installation of mechanical stokers from the labour-saving point of view, offer a wide field for some form of coke-burning fire-grate capable of being mechanically cleaned. The CO_2 records taken from coke-fired hand-fed boilers (to which the tabulated results also refer) will serve to illustrate this point. These clearly show that, with the balanced-draught system in use, the only serious interruption to an otherwise continuous state of high efficiency, rarely approached with coal-fired boilers under the best conditions of mechanical stoking, are the burning-down and clinkering periods.

Soft Coke.

The introduction of "semi" or soft coke, suggested in certain quarters, with a view to effecting fuel "economy" might appeal to those operating gas-works in purely residential districts, if such communities do exist. In industrial districts, many processes, and even certain industries as a whole, are largely dependent upon the well-established characteristics of gas coke; and, in the writer's opinion, to radically and generally modify these in the manner suggested would bring serious hardship to many users having apparatus specially designed for the use of coke, and for which no other fuel would be quite as cheap or suitable. The moral obligation of gas authorities to supply these people with suitable non-volatile solid fuel would appear to be second only to their statutory obligation to supply gaseous fuel of a uniform character and quality.

Steam-Boiler Design.

In the general design of ordinary types of steam-boilers it is difficult to trace any direct influence of fuel characteristics, except, perhaps, in the external setting or baffling. Chief consideration appears to have been given to safety, convection currents, cost, and convenience of construction. That there is little or no difference in the design of gas-works coke-fired boilers and boilers presumably designed to burn coal, would appear to bear out this contention. So far as the boiler makers are concerned, it is the merest accident that the latter are more efficient when fired on coke. In steam generating plant designed to burn coke, the primary considerations, in addition to the above, would be ample grate area and a preponderance of heating surface exposed to the direct radiant and reflected heat of the fire. Except in the matter of unit capacity, progress in this direction, compared with other branches of mechanical engineering, has been remarkably slow. Types installed fifty years ago, and still in use, differ only in matters of detail from those now being made and installed.

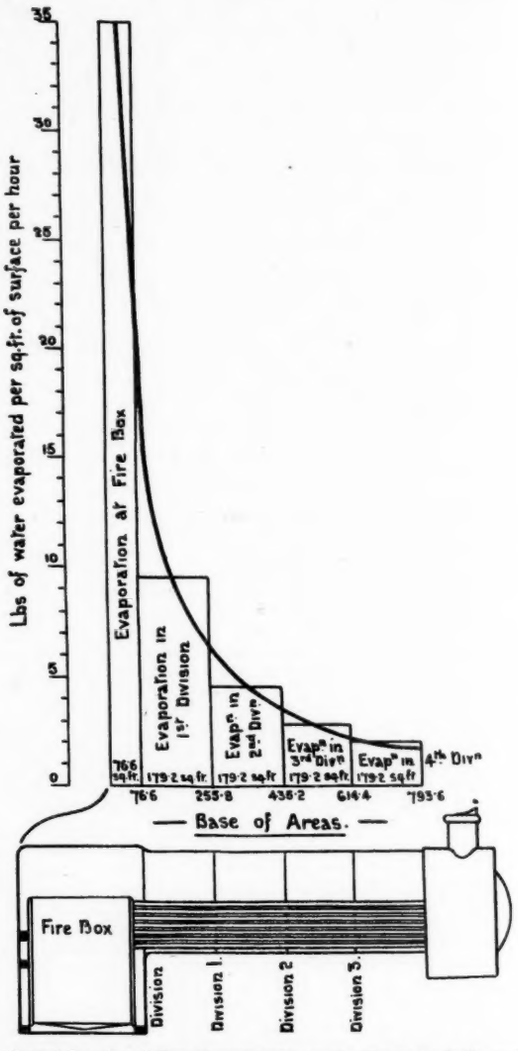
Marine and Locomotive Boilers.

Without due reference to the application of coke fuel to marine and locomotive boilers, this paper would have less claim to be complete. On tug-boats and other river craft, coke has been successfully substituted for navigation coal of the finest quality, with and without forced draught; and applied to dredgers, sludge, and pleasure boats, there would appear to be great possibilities in this direction alone. As to steam-waggons, the Heavy Motor Car Act of 1903, and subsequent regulations limiting tare weights to 5 tons, including motive power, have done much to unnecessarily increase the fuel cost of running these vehicles. In order to comply with the regulations, the fire-box and grate area of the boilers, among other things, had to be reduced in order to cut down weight, with the result that the hourly rates of combustion of fuel necessary to realize the rated capacity of the waggon are too high to be economical, and often exceed 50 lbs. per square foot of grate area. The present tendency is, however, to increase grate areas and fire-box heating surfaces.

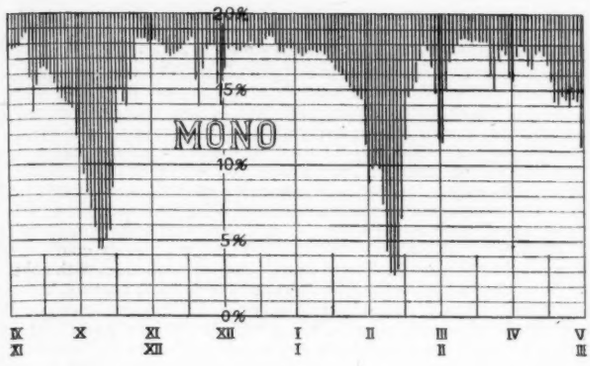
In selecting vehicles for use with coke fuel, gas companies, who are large potential users of this means of transport, would do well to encourage this tendency; and in the interests of national economy in fuel, it is to be hoped that the new regulations now being framed will take due cognizance of these factors. For railway passenger locomotives, the reinstatement of coke fuel to its former position in favour on some of the London lines would now perhaps involve what might be considered a too drastic overhauling of their running schedules; but it is gratifying to note that here also there is a tendency to increase the proportion of grate area to total heating surface. On American railways, where coke breeze, mechanically stoked, has been tried with some success, recent development in this respect, which has the greatest influence on fuel consumption as well as steaming capacity, is shown in the following table:

Ratio of Total Heating Surface to Grate Area.			*Ratio of Fire Box-Heating Surface to Total Heating Surface.*		
1903.		1913.	1903.		1913.
66·4	..	56·1	5·9	..	7·3
Percentage decrease, 15·5			Percentage increase, 23·7		

The changes in these important factors are in the right direction, and may be commended to the notice of British designers of road locomotive and other steam-boilers, in view of the possible trend of coming events in the matter of fuel control. From the diagram, it will be seen that, to produce a given amount of evaporation, less fuel will have to be burned per square foot of grate area, resulting in a higher fuel efficiency and a wider margin of fuel capacity when it becomes necessary to force the boiler; while a distinct gain in thermal efficiency is realized by the increase in the ratio of fire-box area to total heating surface. Reliable tests have shown that 1 square foot of fire-box heating surface will evaporate about five times as much water per hour as will 1 square foot of tube surface. The diagram shows graphically the relative efficiency of fire-box and other heating surfaces, and, although based upon conditions obtaining on a coal-fired locomotive type boiler, it is applicable to any other type. Fired with coke fuel, in which case refractory arches are found to be unnecessary, combustion and evaporation would be still further located to the fire-box area.



Plotted Results of Five Experiments on the Northern Railway of France, on a Locomotive Boiler divided into Five Watertight Compartments, showing the Efficient Evaporative Surfaces.



Fuel Test.

Conducted by ..... Consulting Engineers.

FEBRUARY, 1916.

FUEL TESTED. System of Draught. System of Stoking.	Bituminous Coal. Natural Draught. Hand Fired.	Gas Coke, "L. Coke C." Blowers. Hand Fired.	Gas Coke and Coke Breeze. "L. Coke C." Blowers. Hand Fired.
Cost per ton delivered . .	25s.	25s.	Breeze at 10s. Average at 17s. 6d.
Duration of trial, hours .	6·50	7·25	7·66
Type of boilers (2) . . .	Cornish	Cornish	Cornish
Total grate area, square ft.	58	58	58
Amount of fuel used, lb. .	6720	7500	4200 coke 4200 breeze
Fuel burnt, per square foot grate area per hour, lb. .	Max. 16·1	Limited to 16·1	Limited to 17·1
Water evaporated, lb. actual	45,950	65,600	59,200
Water evaporated per boiler per hour, lbs.	3530	4520	3860
Water evaporated per lb. of fuel	6·83	8·74	7·04
Water from and at 212° per lb. of fuel	7·74	9·80	7·99
Cost per 1000 galls. evap'ed	14s. 5d.	11s. 8d.	9s. 5d.
Temperature of feed water before economizer . .	110° Fahr.	118° Fahr.	107° Fahr.
after economizer . .	218° ,, 108° increase	196° ,, 78° increase	193° ,, 86° increase
Per cent. CO_2	Not taken	16·0 average	16·25 average
Steam pressure	45 lb.	58 lb.	52 lbs.
Net working efficiency of plant, deducting 3 per cent. of steam used under bars for blowing . . .	Not ascertained, probably about 70-72 p.c.	85 per cent. approx.	80·9 per cent. approx.
Financial saving effected by adopting coke fuel and forced draught . . .	—	19 per cent.	34·6 per cent.

Mr. Nicol exhibited at the meeting two scale models of the forced-draught apparatus referred to in the address. These were exact miniature replicas of those which are now being extensively installed on boiler-furnaces, with a view to substituting coke for coal, and which are applicable to furnaces of from 2 ft. 3 in. up to 4 ft. diameter. As to the coke-burning capacity of the apparatus, Mr. Nicol explained that this was limited by the tendency of the fuel to drift upon the grate; but in his experience the maximum rate necessary did not often exceed 25 lbs. per grate foot-hour. At 22·5 lbs., the steam consumption had been independently ascertained to be 3 per cent. of that generated, a figure which would bear favourable comparison with the steam consumption of engine-driven fans.

DISCUSSION.

The PRESIDENT (Mr. S. B. Chandler, of the South Suburban Gas Company), in inviting discussion, said they were much indebted to Mr. Nicol for having come to address them on so important a subject.

Mr. J. G. CLARK (Gas Light and Coke Company) remarked that one thing which had struck him while listening to the address was the great value of coke from the point of view of smoke prevention. With regard to coal, no doubt some of those present had seen recently a report in the "Lancet," in which there were summarized data collected from different parts of the country in reference to atmospheric pollution; and this indicated plainly that coal, unless it was very carefully used, which was not always the case, was likely to give off products which were unpleasant, not only from the point of view of dirt, but from that of rendering the air impure for respiratory purposes. Mr. Nicol had spoken of the importance of the heat basis as a basis for the valuation of coke. This was unquestionably a great thing. Some years ago, the late Professor Vivian B. Lewes, in a lecture entitled "Candles and Calories," sounded the death-knell of the candle, by emphasizing the importance of the calorific basis of measuring. It was just as important in the case of fuel they bought by the ton. Looking at the table, he noticed that the heat value of the coke used was not given. If this were added, it might be useful for reference in judging the other figures. A matter which always struck him in connection with the combustion of fuel was this: The heat from a pound of fuel was developed in at least two ways—part as flame, and part as radiation. This was described in the address. There was no question that the proportion of the heat given off as radiation and of heat as actual flame affected the ultimate efficiency of the fuel from a practical point of view. Coke, he thought he was safe in saying, gave off a larger proportion of radiant heat than ordinary bituminous or any other kind of coal. Mr. Nicol had told them, too, that as a matter of accident the present type of boiler happened to be very well suited for the use of coke. Might not this to a great extent be due to the fact that a large proportion of the heat of the coke was given off in the form of radiation? A more efficient surface for the absorption of radiation than the tubes of a Lancashire or Cornish boiler coated with oxide of iron, one could hardly have. To this extent, coke must be favoured, because the larger proportion of the heat was given off as radiation. On looking at the table, he was impressed by the high figures of CO_2—16 and 16·25 per cent.—when coke was used. These were, of course, exceedingly good—corresponding roughly to an excess of only about 25 per cent. of air; and to thoroughly consume fuel with such a small excess of air, to some extent accounted for the increased efficiency. Mr. Nicol had stated, in describing the locomotive boiler shown in the diagram, that the same argument would apply in the case of a Lancashire or Cornish boiler; but in the locomotive fire-tube, one could not get very much propagation of flame, whereas one might get a lot along a boiler of the other type, as there was much more space. Therefore there might not be such a sharp drop in the curve as they saw was the case with the locomotive. It would tend to level itself, perhaps, by being not so high at the beginning, and not so low at the end.

Mr. F. C. BRIGGS (Gas Light and Coke Company) said the author had mentioned the question of solid fuel being sold on the calorific basis. Was this being practised at the present time? Then there was another point which was rather away from the subject, but which interested them as gas men very much. Had the author any experience of the use of pitch, fired with coke under the boilers? The question of pitch had, as they were all aware, become a serious matter; and it had been suggested that they should carbonize it with coal in the retorts. Certain experiments that had been carried out had led him to form the opinion that this was probably not the way out of the difficulty, and that if they were to get rid of the pitch a more reasonable method would be to burn it under the boilers with coke. There were several difficulties to overcome—particularly that of smoke. It had to be mixed very intimately with the coke, and very carefully fired. Could Mr. Nicol give them any information as to the use of pitch with coke in this way?

The PRESIDENT said he was gratified to see present the Chief Engineer of the South Metropolitan Gas Company, and they would like to hear some remarks from him.

Mr. G. M. GILL said he had not come to the meeting with any idea of joining in the discussion; but when he saw that Mr. Nicol was down to give an address, he had determined that he would be present to hear it, because Mr. Nicol was one of the few people in this country who really understood this important subject. He had given them a highly interesting address, full of information which they ought to study as closely as possible. The subject of the use of coke under boilers was one of the greatest importance to the gas industry. It was a subject which had not received nearly so much attention as it should have done; and it was quite time that gas undertakings made up their minds to push it, and do all they could to introduce it to the notice of fuel users. He would like to make the suggestion that the example set by the London Coke Committee, in appointing an expert to promote the use of coke in the Metropolitan area, should be followed by provincial undertakings throughout the country. It might very well be done by the Commercial Sections attached to the different Gas Associations. He felt sure that if this were done, they would really begin to make progress. Coke as a boiler fuel had always been very much underrated by power users. Why this was, he really did not know; but he thought that what had had a lot to do with it was that coke required more draught than coal. The secret of doing well with coke in a district was to induce as many people as possible to go in for forced draught apparatus such as Mr. Nicol had devised. This was really the secret of the whole thing, if boilers were to work at their maximum capacity fired with coke. Mr. Nicol pointed out that it would not be fair to coke to buy it on a mere calorific power basis. This was very true; and it was shown in the high CO_2 return in the waste gases, which one could get with coke. With coke, being a purely carbon fuel, there was not the same necessity to use a large excess of air. In fact, it was possible to tremendously cut down the amount of air for combustion. As to using pitch under boilers, he was afraid this would not be possible, because pitch fused at such a low temperature. What he was told happened in actual experiment was that directly it was put in the furnace, it ran through between the fire-bars. With reference to coke for boiler purposes, Mr. Nicol had not compared broken coke with large coke; but he (Mr. Gill) believed it was a matter of great importance that broken coke should be supplied. One could not get the same capacity out of the boiler fired with large coke. Then came in the question of breaking coke and the consequent making of breeze. He would like to hear the author's opinion as

to the advisability of supplying coke and breeze mixed—that was to say, taking large coke at the works, and breaking it up, and then supplying the whole of the material, both coke and breeze, which resulted from the large coke put through the crusher. The comparatively small percentage of breeze that would be thus included would not, it seemed to him, prove any great detriment; and the fuel could, of course, be offered at a correspondingly lower price.

Mr. J. HEWETT (South Metropolitan Gas Company) asked Mr. Nicol if he had had any experience in regard to the action of the gases from a coke-fired boiler on the internal parts of the tubes. He could imagine that in a locomotive boiler fired with coal, for instance, where considerable smoke was produced, this smoke would operate more or less as an insulating material, protecting the inside of the tubes, and preventing them from being acted upon to such an extent as they would be by the gases from the coke alone. The more local heating which would result from the combustion of coke would probably have a definite action on the tubes; and he (Mr. Hewett) would be glad to be told that this would be rather in favour of coke than otherwise.

Mr. D. C. CROSS (Lea Bridge) thought it might interest the members to hear one or two figures which he had just taken out. Since Christmas, his Company had adopted the idea of transporting their coke in coke-fired steam-waggons. The waggon they used was of the 3-ton "Sentinel" type, and was delivering from three to four loads a day. The fuel consumption appeared to be exceedingly small. The miles per hundredweight of coke consumed worked out for the three months at 5·8 including lighting up and standing losses; and the average quantity of coke carried was 50 cwt. That was to say, for 1 cwt. of coke burned, they could carry 50 cwt. 5·8 miles. This seemed extremely low, and very encouraging. Taking the coke at 25s. per ton, the cost was 2·6d. per mile, or 1d. per mile per ton carried. After the war, when makers could devote a little more time to pushing waggons of this kind, he thought there would be a great outlet for coke.

Mr. NICOL, in replying on the discussion, remarked that Mr. Clark had raised some points of peculiar interest. The valuation on its calorific basis of coke—and, for the matter of that, any other solid fuel—was, in his own opinion, sure sooner or later to come about. It was established now in the gas industry in the case of gaseous fuel; and it would be only one more step towards standardization generally to sell coke on a heat value basis. But while coal was very often sold and purchased on this basis, it would not, he thought, be an equitable basis in the case of gas coke, simply because, as Mr. Clark had pointed out, it was possible to burn coke under ordinary hand-fired conditions with a 25 per cent. or smaller excess of air, whereas in burning coal under the best conditions of mechanical stoking 50 per cent. was necessary, and under ordinary natural draught 100 per cent., or even 200 per cent., excess was quite usual. The radiant efficiency of coke fuel was, of course, much higher than that of coal, for the reason that it was a purely carbonaceous fuel, and burned freely without smoke or luminous flame. In statements of relative boiler efficiency, the characteristics of fuel were generally neglected; the efficiency being stated merely on the gross calorific value. Mr. Clark was quite right in saying that combustion would be extended to a greater degree along the fire-tubes of a Lancashire-type boiler than in one of locomotive type. Where one was 1 or 1½ inches diameter, the other might be 2 ft. 6 in. or 3 feet. As to Mr. Briggs's question, the calorific basis for coke might very well be reduced to the ash basis, on similar lines to the water basis for tar and oils. The burning of pitch smokelessly under boilers was a matter to which he had given a considerable amount of attention; and, in his opinion, to break it and fire it in the furnace along with other solid and less volatile fuel would be quite hopeless from this point of view. It would no doubt lead to all sorts of troubles in addition to this, by running through the fire-bars and getting into the ash-pit. He had got out a tentative scheme for gasifying pitch and burning the gas in the boiler furnaces, and burning the pitch coke also under the boilers, as it accumulated. In reply to Mr. Gill, the whole subject of boilers and boiler firing should be to gas undertakings, in their capacity as steam users, one of very considerable interest. Compared with other industries, including that of electricity supply, gas undertakings were probably among the largest steam users. In the case of two companies that were represented on the London Coke Committee, there were no less than 425 boilers in use. These, without exception, he believed, were coke-fired, and for the most part under forced draught conditions. The boilers were insured with the usual boiler insurance companies; and so far as he had been able to ascertain, no comment whatever had ever been made by the insurance companies' inspectors with reference to the action of gases from the coke fuel affecting the boiler-plates. There were cases of boilers of the most sensitive type in this respect—the Babcock water-tube boiler—having run continuously with coke fuel for fifteen years without the renewal of a single tube. Mr. Gill's suggestion that Coke Committees should be set up in the Provinces appealed to him as being a thing that should go without saying, because the effect on the market generally of an accumulation of provincial coke was very noticeable. It seemed to him, however, that there should be no good reason why testing plant should be duplicated and laid down, with a view to collecting data regarding coke fuel. If the plant were located at one centre, it would be the better plan; and the information collected could be distributed to those interested. As to broken coke, in some instances, where the rate of combustion required was high, it became necessary to employ coke so graded as to ensure the maximum rate attainable. The breeze made by reducing hard coke to this grade might very well be delivered with the coke; but as this had been a source of complaint in the past, it would be unfortunate to establish any method which would give careless loaders a loophole. It did occasionally happen that breeze was sent out now, without any such loophole being allowed, with very serious consequences in certain cases. The carbonaceous scale deposited on the heating surfaces of locomotive and other coal-fired boiler tubes not only acted as a preservative of the tubes, but incidentally was a very effective insulator—he believed about five times as effective as asbestos. It took from three days to a week of coke firing with a boiler which had been previously coal fired, to get rid of this scale. There was no detrimental effect with coke, so far as he had been able to ascertain, due to local heating. After all, it was only a question of intensity; and if a steam user could not obtain sufficient steam with an inferior coal, he had no hesitation in using coal which would develop a much higher heat. The fuel cost of running steam-waggons on expensive Welsh coal was a point which had not been lost sight of by the London Coke Committee. The remarkably low figures quoted by Mr. Cross showed that to start with a steam-waggon such as the "Sentinel" designed to burn coke was a better proposition than taking a waggon that had been badly designed to burn coal, and subsequently firing it by coke. The "Sentinel" was a waggon that the makers said would do better on coke than on any other fuel.

Mr. HEWETT: Is it the rule to state the calorific value of coke on the dried or the undried basis?

Mr. NICOL replied that in these tests allowance had been made for the moisture. The calculation was based on the calorific value of the coke, including moisture and ash.

The PRESIDENT said the London Coke Committee were doing excellent service, and were to be congratulated upon having such an exponent as Mr. Nicol. Everyone must have noticed the large number of steam-lorries that were now on the roads.

A hearty vote of thanks was passed to Mr. Nicol for his address, on the proposition of Mr. CLARK, who said that as time went on the gas industry would be under a growing debt of gratitude to Mr. Nicol for popularizing the use of coke for industrial work.

Mr. BRIGGS, in seconding, urged that more attention should be paid to the economical raising of steam on gas-works.

Mr. NICOL returned thanks. He said it had been a great pleasure to read the paper. While his remarks applied to conditions prevailing in the London district, the views expressed were given entirely on his own responsibility.

Evening Star Lodge.

The installation meeting of the Evening Star Lodge was held at the Freemasons' Hall, Great Queen Street, E.C., last Wednesday, when the retiring W.M. (W.Bro. Arthur E. Croager, P.P.S.G.D., Kent) installed his successor, W.Bro. J. Fred. Wicks. Subsequently, the following officers were invested:

Senior Warden	Bro. A. P. Main.
Junior Warden	W.Bro. Fred J. West.
Treasurer	,, A. E. Broadberry, L.R.
Secretary	,, W. T. Dunn, L.R.
Senior Deacon	,, H. W. Packham. P.P. J. G. D. Surrey.
Junior Deacon	Bro. Corbett W. Woodall.
Director of Ceremonies	W.Bro. E. G. Smithard.
Organist	Bro. J. F. Simmance.
Inner Guard	,, H. G. Warren.
Stewards	,, Alfred C. Beal. ,, Charles Clare. W.Bro. R. W. Foster, L.R.

W.Bro. Wicks was initiated into Freemasonry in the Evening Star Lodge on Oct. 24, 1900. He was a founder of the Beaconsfield Lodge, No. 2849, in 1901, and is a member of the Evening Star Chapter.

Gas Supply in Norway.—According to a "Chemiker Zeitung" report, the sixteen gas-works in Norway, of which ten are under private and six under municipal ownership, in the year 1914-15 produced 1493 million cubic feet of gas, as compared with 1300 million cubic feet the preceding year. The number of consumers rose in the same period from 61,704 to 68,076. The quantity of coal used in all the works was about 133,000 tons, against 120,000 tons in the year 1913-14. Owing to the export of tar having been prohibited since the outbreak of war, the gas-works, which formerly disposed of their tar to German distillers and colour works, have had to use it as fuel in place of coke.

Society of Engineers.—At a meeting to be held next Monday, at 5.30, in Caxton Hall, Mr. J. E. Lister will read a paper entitled "Modern Coal and Coke Handling Machinery, as Used in the Manufacture of Gas." It is the intention of the author to deal with the production of gas from coal; the cost of handling coal and coke; the introduction and development of mechanical stoking in gas-works; various retort charging and discharging machines; coal unloading, breaking, elevating, and conveying machinery; scraper, bucket, and belt conveyors; coke-handling machinery; conveyors and telpherage plants; vertical retorts; adoption of coke-ovens for the production of town's gas; and coke-oven charging and discharging machinery.

THE POSITION OF SCIENCE.

Professor Armstrong's Views.

The second of his two Royal Institution lectures on "Explosives and Drugs Made from Coal Tar Products," was delivered by Professor H. E. ARMSTRONG, F.R.S., last Thursday afternoon, when information was given regarding many well-known drugs.

In the previous lecture [*ante*, p. 632] attention was devoted to explosives; and on resuming his subject, Professor Armstrong drew attention to the recent speech of the Chairman of the Bradford Dyers' Association, which was dealt with in the "JOURNAL" at the time, in which the close connection was pointed out between explosives and dyestuffs—the materials were the same, and the works which prepared one prepared the other. The lecturer said he did not think it was generally realized how much the Royal Institution, through Faraday, was linked-up with these industries. In his early days, Faraday was a chemist, and did work of extraordinary brilliance. Faraday it was who, when experimenting with oil gas, discovered benzene—one of the chief pillars of organic chemistry, and the foundation stone of the organic chemical industry. Benzene was discovered and defined in that Institution over ninety years ago. The study of the light hydrocarbons of coal tar on the lines laid down by Faraday in his pioneer investigation of the bye-products of the oil-gas industry, was undertaken close by, at the Royal College of Chemistry, in 1846. Benzene and toluene were then separated for the first time. Ten years later, the first artificial dye was discovered and manufactured from benzene in this country, near Harrow. The first time a perfume was made artificially was also in this country, again near Harrow. The connection between chemical constitution and physiological action was first brought into prominence by the inquiry of Crum Brown and Fraser, carried out in Edinburgh, in the late sixties. Abel brought the guncotton industry into stable existence in the early sixties, and the application of guncotton in conjunction with nitro-glycerine to military use was in the main the work of Abel and Dewar.

Why, asked Professor Armstrong, after being pioneers so often, and having done so much, have we allowed ourselves to fall so much behind, and be so dependent upon others? Why is it necessary now to urge that science and industry must be brought into conjunction? These and many other questions must be pondered and answered—and so answered that we can do better in the future. Our failure is traceable to Oxford and Cambridge, and the public schools. We have placed so high a premium on classical studies that most of the ability of the country has been either forced or attracted away from science; and the nation has been kept in ignorance of science by the literary party, almost of set purpose, it would seem. As there has been no regular remunerative outlet for science, few have been led to take it up; and the few who have, finding little opportunity in industry, have sought for recognition elsewhere. No sufficient use is being made of the resources the Royal Society commands. The men of most experience in the country have been allowed to remain unutilized—the services of those who have been taken have too often been misapplied.

Proceeding, he said: The waste which is taking place through faulty organization of effort is colossal. Opportunities of future development are in no way taken into account. It is not that science is unable to help; it is simply not allowed to do so properly, the work being largely in the hands of the inexperienced. It is useless, however, for us to complain of Government apathy, of public ignorance of science, when we, the body scientific, are unable to cope with our own affairs—while we remain unorganized in our own service. My anxiety for the future arises mainly from the apathy I find everywhere; from our inability to look the trouble in the face; especially from our unwillingness to combine forces. Science, it is to be feared, in this country at the present time is losing rather than gaining caste. This is because it is ineffective in its collective aspects, and therefore voiceless in the councils of the nation.

On the day preceding the lecture, it seems, a conference convened by the President and Council of the Royal Society was held; and it was decided by the representatives of the scientific and technical societies present that it was desirable to establish a Conjoint Board of Scientific Societies for the purpose of: (1) Promoting the co-operation of those interested in pure and applied science. (2) Supplying a means by which the scientific opinion of the country may, on matters relating to science, industry, and education, find effective expression. (3) Taking such action as may be necessary to promote the application of science to our industries and to the service of the nation. (4) Discussing scientific questions in which international co-operation seems advisable. A Committee was appointed to draft a scheme.

Yorkshire Junior Gas Association.—Arrangements have (by permission of Mr. Charles Wood, the Engineer and Manager) been made for the members to visit next Saturday the Birkshall works of the Bradford Corporation Gas Department, where a 5 million cubic feet installation of Woodall-Duckham vertical retorts is now in course of erection. The Hon. Secretary (Mr. Edward Garsed) says the Council hope to hold two more meetings this session.

CORRESPONDENCE.

[We are not responsible for opinions expressed by Correspondents.]

Tar and Pitch Prices.

SIR,—The letter of "N. W." in your issue of the 21st inst. so nearly agrees with prevailing conditions at my works, that I am constrained to state the result of my inquiry to our tar distillers for pitch for carbonization, and let your readers agree how much bluff there is in some of the tar distillers' protestations as to profitable prices, and how much genuine desire to meet and make the most of circumstances.

Some time before receiving the circular letter of Mr. Young, the President of the Institution of Gas Engineers—*re* the "Carbonization of Pitch"—I approached our tar contractors for a price delivered at our works for pitch to experiment with, promising, if successful and price right, to relieve them of a quantity equal to 5 per cent. of my coal carbonized. They pay 21s. per ton at our works for the tar.

At the time of my inquiry, the "JOURNAL" price for pitch at Liverpool and Manchester was 14s. to 15s. per ton; and these are the nearest comparative prices available with my works. I expected something like 17s. to 18s. delivered, which is considerably above the basis suggested in Mr. Young's circular-letter.

The quotation was 20s. per ton net cash at their works, and carriage 3s. 6d. per ton—making a total of 23s. 6d., which is well over the price at which I am putting coal carted and trimmed into my works.

No amount of persuasion or counter-offers will move the firm one jot from their original offer; while they take the opportunity of reading us a homily on the absolute beggary the present contract prices for tar are reducing them to, &c., &c.

Now, I am not out for a one-sided bargain; but if, as the tar distillers say, the immense accumulations of pitch are reducing the value of tar, and gas authorities are willing to pay the current price of pitch, and so relieve the congestion, it hardly sounds logical for the tar distillers to adopt an attitude which practically (as in my case) puts the question entirely out of court. Besides, one has no guarantee that taking the pitch off their hands is going to have any financial advantage on the next contract price of tar.

The circumstances prevailing almost justify one in suspecting that the tar distillers and contractors do not want to ease the market, for fear they will have to pay an enhanced price for tar.

Gradually, gas managers are being forced into a corner in this and other matters; and when normal times come again, Parliament, as a return and reward for their present work of a national character, should surely be asked to sanction collective action on such matters, so as to break-up rings.

T. W.

March 23, 1916.

SIR,—The letter of "N. W." in your last issue, drawing attention to the depressed price of tar, which he thinks has been artificially created by the distillers, is worthy of very serious consideration.

Within the past few weeks this works had to seek the aid of the Ministry of Munitions in disposing of treated tar stocks. General congestion, due to pitch accumulation, was ascribed by the distillers as the reason for inability to forward loading tanks. On receipt of the Institution circular, suggesting the carbonization of pitch as a remedial measure, we wrote the distillers for a price—intimating that the chief object was to relieve their works' congestion and enable distilling to conveniently proceed. We were asked 27s. 8d. per ton for pitch, f.o.r. here. We receive 15s. per ton for treated tar at the same point. The rail-rate is less than 5s. per ton in each case.

Such offers place the possibility of pitch carbonization quite out of court, unless gas undertakings can afford it, and are prepared to sink the financial aspect of the matter entirely. They suggest the thought that tar distillers are not disposed to assist patriotic endeavour designed for the relief of their own stated difficulties. Such a position will not be accepted without protest.

Referring to tar, we have heard of works in this district where it is being stocked and held, rather than sacrificed at to-day's figures. Holding tar in these times will hardly commend itself to general approval; and some of us have not the means to do so, given the wish. There appears to be a crying need for organized action to safeguard the interests of tar producers in their dealings with certain of the tar distillers.

With regard to the price quoted on this works for pitch supplies, we have placed the correspondence, including the Institution's letter advocating pitch carbonization, before the Department of Explosives Supplies, and already feel assured that full investigation will be made, in the interests of light oils production.

We imagined that the tar grievance was more particularly confined to this district where distillers are few, and even the "JOURNAL" prices, mentioned by "N.W.," do not apply. If, however, his letter denotes general dissatisfaction in other districts, we believe that united application would lead to the intervention of the before-mentioned Government Department, and reap its due reward.

J. ALEX. GRAY.

Gas-Works, Teignmouth, March 25, 1916.

Mortgage Bonds.

SIR,—In reply to the two questions of "Enquirer,"

1. Our construction of the letter from the Inland Revenue is that the duty is 6d. only, irrespective of the amount of the bond.
2. Yes; that is how I understand it.

ACCOUNTANT.

March 23, 1916.

Professor Armstrong and Fuel Economy.

SIR,—As one who is largely occupied in the evaluation of fuels, I should like the opportunity of thanking Professor Armstrong for his contribution to the discussion before the London Section of the Society of Chemical Industry, on the 6th inst.

One cannot always agree with Professor Armstrong, but his contri-

butions to discussions frequently contain the kernel of what other and more diffident people are thinking.

The Society of Chemical Industry should certainly take this question of the economy of fuel in hand. It could not be under better auspices; and a small strong Committee of this body will inspire confidence among those whom the subject most directly concerns.

E. W. SMITH.

Birmingham, March 21, 1916.

The Economy of Fuel.

SIR,—I have read with interest the paper contributed by Professor H. E. Armstrong to the Society of Chemical Industry and the remarks of Professor W. A. Bone, together with the discussion, as reported in the "JOURNAL" for March 14; and I hope that the result will be a more general and public interest taken in this important and national subject.

Professor Armstrong rightly says that the coal industry in general, and the use of fuel in particular, should be brought under scientific control, with two great objects in view—the saving of the valuable bye-products at present dispersed into the air, and the avoidance of the great loss caused by unnecessary smoke—highly deleterious and wasteful alike from a financial and a hygienic point of view.

I should, however, at present like to make a few remarks upon the "ideal fuel" for domestic grates, in reply to some of the remarks of Mr. W. J. A. Butterfield in the discussion on the question.

English people are agreed that the up-to-date open grate will remain with us, because of its value for ventilation, and on account of its cheerful appearance. We must, therefore, find a suitable fuel for this grate, by which I mean that it must burn with a good flame, without smoke, must contain a low percentage of gas, and ignite easily after having undergone a process to obtain the valuable bye-products.

These conditions we have in semi-coke—the resultant fuel after a low-temperature treatment. Mr. Butterfield objects that low-temperature coke has nearly double the bulk of raw coal, which I admit. But, on the other hand, I contend, and I feel sure Professor Armstrong will agree, that the radiant heat is far greater, and that in consequence, in practice, Mr. Butterfield's objection to it, on account of its bulk, is not so serious, as less is required.

Mr. Butterfield says: "Low-temperature coke appeals to a certain class of well-to-do consumers, who like the pleasant glow of the fire which it affords, and are gratified by the impression that in using it they are displaying their superiority to other people."

On the other hand, I maintain that it is essentially a fuel for those who have to consider the question of cost and money value. As regards its value from the hygienic point of view, if Mr. Butterfield will apply to the Secretary of the Coal Smoke Abatement Society, he will be supplied with information that will satisfy him.

Mr. Butterfield suggests another form of solid fuel—namely, coke breeze briquettes. But he cautiously adds that the breeze must not contain an excessive amount of ash, which is an impracticable proposition. An additional objection to this, however—quite apart from the fact that there is only a comparatively small quantity of coke breeze made—is found in the fact that you cannot mix pitch with any fuel without having a considerable amount of smoke when burning it. On the other hand, soft coke breeze would contain more volatile, and therefore would require less pitch for briquetting, and in consequence give off less smoke.

With reference to his remarks as to the present low price of pitch and tar, it should not be forgotten that this is entirely attributable to the existing war conditions.

R. SLOANE RICHARDS,
Smokeless Fuel Syndicate, Limited.

101, *Leadenhall Street, E.C., March* 24, 1916.

Withdrawing Coke from Stop-End Retorts.

SIR,—I note from the last "Register of Patents" that Messrs. Gibbons and Masters have patented a device for withdrawing coke from stopped-end retorts. It may not be news to them that the identical rake was made by me, and used at the Dorking Gas-Works, some ten years ago. It had other advantages besides mechanical.

S. CARPENTER.

Cromer Gas-Works, March 23, 1916.

Ironite on the Concrete Purifiers at Romford.

SIR,—Referring to Mr. Child's paper and the discussion thereon [as reported in the "JOURNAL" for March 21] at the recent meeting of the Southern District Association of Gas Engineers and Managers, we should like to point out—in reply to the question Mr. Glover raised, as to the permanent effect of Ironite—that, when Ironite has thoroughly matured, it remains inert, and is consequently not affected by gases, and acts as an efficient protection to the concrete. We should also like to point out that, should any cracks appear in the concrete, these can be easily repaired with Ironite, applied either internally or externally.

IRONITE COMPANY LIMITED,
per SAMUEL C. F. VINES, Director.

11, *Old Queen Street, S.W., March* 24, 1916.

The Carbonizing Plant at Southampton.

SIR,—With regard to the latter part of your leader in the "JOURNAL" this week, on the question of verticals, I did not quite catch the President's comment, or should have pointed out that the extension of the carbonizing plant was decided upon in 1912, as stated in my paper. That was four years ago. Naturally, at that date there was not so much known about verticals as since. Even now there are, from what I can gather, constructional defects to be overcome.

Still another point, it was doubtful whether verticals would suit the class of coals we are accustomed to use, without changing for something which would possibly cost more.

I think a few lines should appear in your next issue to point out that the decision for horizontals was made four years ago.

F. DURKIN, Resident Engineer and Manager,
Southampton Gaslight and Coke Company.

Southampton, March 23, 1916.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

The following further progress has been made with Bills:

Bill brought from the Commons, read the first time, and (pursuant to the Private Legislation Procedure, Scotland, Act, 1899) deemed to have been read a second time, and reported from the Committee: Aberdeen Corporation Water.

Bill read the third time, passed, and sent to the Commons: Burnley Corporation Water.

Imperial Continental Gas Association Bill.

The Unopposed Bills Committee of the House of Lords last Tuesday sent this Bill forward for third reading, subject to communication being made with the Colonial Office respecting it and to any comments of the department. It was pointed out to the Committee that the Association, which was formed in 1870, own undertakings abroad and in the colonies, and generally had powers to hold shares in other similar undertakings. Some doubts have arisen, however, as to the right of the Association to hold shares in other companies, or to dispose of any shares so held; and the Bill now makes the position quite clear. The Association take powers to purchase, lease, &c., gas or other lighting undertakings in the United Kingdom, the Colonies, or foreign countries, and to work in conjunction with other bodies or persons for the same purpose.

HOUSE OF COMMONS.

Uxbridge Gas Bill.

This Bill was down for consideration last Wednesday by a Committee of the House of Commons presided over by Sir W. Howell Davies. Opposition had been entered by the Slough Urban District Council and the Eton Rural District Council; but this was withdrawn, and the Bill has been referred to the Unopposed Bills Committee.

The following further progress has been made with Bills:

Bill brought from the Lords, read the first time, and referred to the Examiners of Petitions for Private Bills: Burnley Corporation Water.

Bill read a second time and committed: Gas Provisional Orders.

Bill read the third time and passed: Aberdeen Corporation Water.

The petitions against the Uxbridge Gas Bill having been withdrawn, it has been referred to the Committee on Unopposed Bills.

The National Pawnbrokers' Association of Great Britain and Ireland, and the North and South Shields and District Pawnbrokers' Protection Association have withdrawn their petition against the Tynemouth Corporation Bill.

Unopposed Bills.

A Committee, consisting of the Chairman of Ways and Means, the Deputy-Chairman, Sir Francis Edwards, Mr. Turton, and Mr. Moon, will meet on Thursday, to consider the following Bills: Plymouth and Stonehouse Gas, Uxbridge Gas, Wakefield Corporation Water.

"Starred" Occupations.

Mr. CAUTLEY, on Tuesday last week, asked the Under-Secretary of State for War whether he was aware that G. F. Evans (single), who, with the assent of his employers, the Lea Bridge Gas Company, attested under Lord Derby's scheme on Dec. 8, 1915, and was placed in Group 9, which was called up early in February, on presenting himself at the recruiting office, was informed that he was not required, on the ground that he was on the "starred" list; and whether he would take steps to see that "starred" men who are willing to serve and not indispensable should be accepted for the Army?

Mr. TENNANT replied that the instructions issued to recruiting officers were that they should note carefully, and carry out fully, the protection given to certain occupations by the fact that they have been "starred." A starred man who was willing to enlist and was not regarded as indispensable by his employer could be taken for the Army, provided that the conditions laid down by the Departments concerned were complied with.

Metropolitan Water Board.

Major NEWMAN asked the President of the Local Government Board whether he was aware that a precept from the Metropolitan Water Board had been received by the Southgate District Council showing an increase of over £400 on the precept for the preceding year; whether he could give any reason for this increase; and whether he was aware of the economy that could be effected if the local authorities were allowed to collect the whole of the water-rate?

Mr. LONG said that he was aware of the increase referred to, but he might observe that the amount of the precept for the preceding year was abnormally low, owing to special reasons. With regard to the last part of the question, the proposal had been considered by the Metropolitan Water Board, and on Feb. 7, 1913, they passed the following resolution: "That, in the opinion of the Board, it would be impracticable to collect the water charges with the local rates so long as those charges are made upon the water consumers only, and not levied as a public rate upon the ratepayers at large."

Sulphate of Ammonia.

Replying, last Thursday, to Mr. Ginnell, Mr. RUNCIMAN stated that he was not in a position to anticipate, with any degree of accuracy, what the demand for sulphate of ammonia would be after the war, or the prospects of its profitable production.

LEGAL INTELLIGENCE.

Lights at a Bye-Products Works.

Martin F. Holliday, the Manager of a North Country Colliery, was charged last Wednesday with not having extinguished the colliery lights on the night of the 5th inst., when there was a Zeppelin raid on the Eastern Counties. It was stated that a notice was sent to him to extinguish all lights, and that some time later he telephoned to the police stating that the men refused to work without lights. The reply was that permission to use lights could not be given; and defendant then said: "I must not endanger the lives of the men working here, and must use my own discretion." Later three arc lights (one not shaded) were observed burning at the ovens. Defendant said there was great danger of the bye-products plant blowing up. For the defence, it was stated that, in view of the danger likely to follow a cessation of work, it was considered justifiable to use subdued light so as to permit of the continuance of the work. Defendant declared that he could not run the risk of forty or fifty men being blown into the air; and he gave instructions for three shaded lights to be used. He considered he chose the lesser of two evils. He was fined the maximum penalty of £100.

Accident to a Workman.

In the Civil Court at Leeds Assizes, last week, a verdict was found for the plaintiff in a case in which R. Sykes, of Batley, sought damages from the Yorkshire Iron and Coal Company, Limited, in respect of an accident to one of the plaintiff's workmen in May, 1914. The plaintiff's workmen were erecting gas-purifiers at the defendants' works at Ardsley; and the allegation was one of negligence in gas being allowed to escape, as the result of which a workman was overcome, and fell from the internal scaffolding, breaking his spine. The defence was a total denial of responsibility.

Claim Arising out of an Accident.

At the West Riding Assizes, Mr. Justice Sankey and a Jury had before them an action which raised the question of who was responsible in law for causing the death of a workman at Penrith. The action was for damages for alleged negligence, brought by Drakes Limited, against William Grisenthwaite, a builder, of Penrith. From the statement of claim, it appeared that on Dec. 8, 1914, in the course of erection work at the Penrith Gas-Works, a man named Steward, employed by plaintiffs, was accidentally killed. The plaintiffs admitted liability under the Workmen's Compensation Act, and paid £300 to the widow. This sum, together with costs, the plaintiffs sought to recover from the defendant, on the ground that the accident was caused by the negligence of the defendant's servant. Mr. Tindal Atkinson, in opening, said the defendant was putting up the brickwork of a retort-house at Penrith; and the plaintiffs were erecting the steel roof of the house. Defendant had fixed a scaffold, with a platform about 30 feet from the ground. One of his men was engaged in carrying stones in a hod up a ladder to the platform; and when he arrived with one load he stood the hod against a steel stanchion, and commenced to unload it. While he was doing so, the hod shifted, and a piece of stone fell on to Steward, who was working on the ground below. It struck him on the head, killing him practically instantaneously. The plaintiffs alleged that the defendant was negligent in not providing a guard board, tarpaulin, or other protection against falling stones or bricks. The defence was a denial of negligence. The Jury returned a verdict for the plaintiffs.

MISCELLANEOUS NEWS.

AUSTRALIAN GASLIGHT COMPANY.

The Half-Yearly Meeting of the Company was held in Sydney on the 10th ult.—Mr. G. J. COHEN in the chair—when the Directors reported that the profits for the six months ended Dec. 31, with the balance brought forward, amounted to £67,352. A dividend for the six months was recommended at the rates of 7 per cent. per annum on the "A" and "B" shares and 6 per cent. on the "C" shares. The Directors decided last August to increase the capital by the issue of 50,000 "C" shares of £6 each; but, in view of existing conditions, they have for the present postponed further action. The Necessary Commodities Control Commission had been holding an inquiry into the price of gas. No final decision had been come to; but there was every reason to believe that, when the whole of the evidence had been submitted, the present rate would be maintained. The industrial agreement with the Gas Employees' Union having expired, the Wages Board appointed under the Industrial Arbitration Act were sitting with the view of making a fresh award.

The CHAIRMAN said the operations during the period under review showed signs of improvement in several directions, the exception being the slight decrease in the consumption of gas, due principally to conditions occasioned by the war, which had undoubtedly caused economies in domestic affairs in which the use of gas played so important a part. Much to the regret of the Directors, the Necessary Commodities Control Commission, in September last, intimated their intention of holding another inquiry into the price of gas. The matter in due course came before the Commission; but the case not having been completed by the end of the year, it was postponed for a time. The Board naturally thought that the previous decision of the Commission on this subject would have been allowed to remain in force until after the war—particularly as the recent Gas Act contained special provisions for regulating the price of gas. A question had been raised as to whether, owing to this Act, the Company came within the scope of the Commission. The industrial agreement with the Company's workmen having expired, notice was received in September last that it was the men's intention to apply to the Wages Board for a new agreement, and an award as regards wages. This application was receiving the attention of the Wages Board, whose decision was being awaited with much interest, seeing that, if the claims were granted, the cost of production would be materially increased. The proposal to augment the capital by the issue of 50,000 "C" shares was fully considered by the Board; but, having been assured by the best financial authorities in the city on these matters that the present time was inopportune to call up so large an amount of capital in face of the Commonwealth War Loan, the Directors reluctantly deferred further action, though it was imperative that more capital should be raised. There was a new item appearing in the balance-sheet under the heading of general charges—"allowances to employees on active service." This expenditure, he felt convinced, would appeal to the shareholders, under the circumstances connected with the disastrous war. The Company's "Roll of Honour" contained 226 names, including 20 of the clerical staff. He regretted having to report the death of seven at the front, and that others had been incapacitated by wounds and illness. The remaining members of the staff were loyally carrying out the increased work devolving upon them. Regarding the public lights, these had increased during the past year by 91; the total number now in use being 7355. The usual increase in sales of gas-cookers, which was somewhat checked at the commencement of the war, was now being gradually overtaken; the total number disposed of to date being 41,712, an increase of 1664 for the half year. The increase in the number of consumers for the period under review was 3582; the total being 129,440. Ninety miles of mains and services had been laid during the past six months. He was glad to be able to report that the long-outstanding claim against the Government with regard to the amount of compensation to be paid to the Company in respect of the resumption of their property in Kent Street had at last been settled. An agreement was come to by which the whole matter was referred to arbitration; and it was decided that this should be conducted without legal representation—the Board being largely influenced in agreeing to this course by Mr. P. T. Taylor (the Deputy-Chairman) consenting to take upon himself the burden of conducting the case on behalf of the Company. So successfully had he done so that the Arbitrators had awarded the sum of £535,000 to be paid to the Company. The proceedings had been very lengthy; and the preparation of the case on behalf of the Company, under the supervision of Mr. Taylor, had entailed an immense amount of labour on the part of the Secretary (Mr. R. J. Lukey), the Acting-Engineer (Mr. Andrew Wilson), and the other members of the staff. Mr. Taylor conducted the matter with great thoroughness and tact; and he (the Chairman) would ask them to tender him a hearty vote of thanks for his valuable and successful services, and request him to accept such remuneration as the Board might think proper.

The report was adopted, the dividends recommended were declared, and a special resolution of thanks to Mr. Taylor was passed.

The arbitration referred to by the Chairman had reference to the taking of certain land in the possession of the Company, for the construction of a road and wharves by the Harbour Trust. The Arbitrators were Mr. J. N. Reeson (Chief Engineer to the Melbourne Metropolitan Gas Company) and Mr. P. C. Holmes Hunt. Mr. F. Leverrier, K.C., was appointed Umpire in case of disagreement between the Arbitrators; but his services were not requisitioned.

KINROSS GAS-WORKS PURCHASE.

The proposed arbitration for the purchase of the undertaking of the Kinross and Milnathort Gaslight Company by the Kinross Town Council has now been departed from, and a settlement arrived at between the parties. The Council on June 10, 1914, served upon the Company a notice to treat in terms of section 21 of the Burghs Gas Supply (Scotland) Act, 1876; and the Company, on Aug. 6, 1914, intimated to the Council their willingness to treat. The Council and the Company thereafter appointed arbiters. In consequence of the financial situation due to the outbreak of the European War, it was deemed advisable that the arbitration should not further proceed; and the parties have now adjusted the terms of agreement.

The Town Council, with consent of the Company, withdraw and cancel the notice to treat. The Town Council further bind themselves not to serve a new notice to treat upon the Company, or take any proceedings in virtue of the powers conferred upon them by the Burghs Gas Supply (Scotland) Act, 1876, with respect to the acquisition of the undertaking of the Company for a period of seven years from and after the 10th of June, 1914. The Company, in consideration of the obligation given by the Town Council, withdraw all claims against the Town Council in respect of the expenses which have been incurred by the Company in connection with the notice to treat. The Gas Company, therefore, will pay their own expenses, the Town Council meeting their expenses, including that of the arbiters and oversman.

The matter is of interest, having regard to the fact that this is probably the first instance of an arbitration of the kind in Scotland being departed from—due to the present financial situation.

TRIBUNALS AND EXEMPTION APPLICATIONS.

The Felixstowe Gas Company applied to the Military Service Tribunal for the exemption of their head clerk and their only fitter. It was stated that the clerk had now to take charge, in the absence of the Secretary and Manager (Mr. F. Paternoster), while the fitter was the only one remaining out of four who were usually employed before the war. The recruiting officer stated that the clerk was not employed inside the works, and therefore the claim could not be entertained. It was suggested that the Company might find a competent woman to take the place of the clerk, and that temporary exemption

should be granted for six weeks to enable the Company to try and fill his place. As to the fitter, conditional exemption might be granted. The clerk also applied on the ground of financial hardship, and that he had a delicate wife and three children. The Tribunal agreed to the suggestions stated.

Before the local Military Service Tribunal, the Tynemouth Gas Company appealed for the exemption of one of their employees—a plumber. The Secretary (Mr. J. J. Carr) pointed out that the man, who was an expert in adjusting meters, &c., was in a reserved occupation, and that the Company had already parted with as many men as they could spare. The military representative offered no objection to conditional exemption so long as the man remained in his present employment, and on the understanding that he joined the Volunteer Training Corps. The Tribunal agreed to this.

Mr. David Terrace, the Gas Engineer and Manager to the Middlesbrough Corporation, applied to the County Tribunal, sitting at Middlesbrough, last Friday for the exemption of a gas-meter fitter. The Clerk pointed out that the man was not in any way employed in the manufacturing of gas or on work in connection with bye-products. The Chairman: You will have to do with a less number of employees. Mr. Terrace: Well, the consumers will have to suffer, that is all. There are 25,000 consumers. It was stated that 50 per cent. of the gas-works employees had enlisted. The decisions in individual cases were not divulged. With reference to another Gas Department employee, it was stated previously that he had been engaged in the preparation of plans for extensions and alterations; but the Clerk pointed out that the Gas Manager had now abandoned this plea, and said that the man was employed in dealing with the settlement of a gas-tank.

Alfred J. Lemmon, an engine driver in the service of the Dorking Water Company, who has charge of valuable pumping plant, was granted conditional exemption at last Wednesday's sitting of the local Tribunal.

Exemption was applied for on behalf of a prepayment meter collector at Malvern, on the ground that it was in the national interest that he should be kept at his work. He was put back until June 30, to enable him to balance his books.

The Woking Water Company applied for the exemption of the following men on the ground that they were indispensable: Alfred Aldridge (waste inspector), Arthur Howard (internal pipe fitter), L. Privett (engine driver), and F. Day (engine driver and stoker). In the case of the first three, it was stated that the men were married and unattested, whereupon the Chairman remarked that they were "as free as the birds in the air." Day was granted three months' exemption.

At Oxford, Ronald S. B. Goodsell appeared before the Tribunal, and declared that he had a conscientious objection to all work connected with war. When he made his appeal, he was Gas-Works Manager at Shipton-under-Wychwood, under the United District Gas Company; but now he was helping to re-model the works at Wadhurst. His father was the Manager of the Charlbury and the Shipton Gas-Works, and he assisted him. He was himself made Manager of the Shipton Gas-Works in 1914. The application was refused.

The Braintree and Bocking Gas Company applied for exemption for two gas-fitters, who also inspected meters. It was stated that the Company had already lost four fitters, who had joined the Colours; and the services of these two men were indispensable, and necessary in the National interest. One man was allowed until July 1, and the other until July 31.

Before the local Military Tribunal on Friday, the Manager of the Brierley Hill Gas Company (Mr. W. C. Jones) applied for temporary exemptions for two employees—a month in one case, and two months in the other. He explained that the Company had 6000 meters; and these two men were chiefly engaged as inspectors and slot-meter collectors. Women were being trained to do work previously done by men. The Tribunal granted the exemptions asked for.

Application was made by the Richmond (Surrey) Gas Company for the total exemption of a number of their employees. Mr. T. May (the Secretary and Engineer) stated that over 50 per cent. of the Company's men had joined the Colours, and they were paying £1100 a year in allowances to dependants. The Advisory Committee recommended that nearly the whole of the men in the list should be exempted; and the Tribunal confirmed this recommendation.

Christchurch (N.Z.) Gas Company.—It is stated in the annual report of the Company that seventeen members of the staff have joined the Colours. The positions of these men are being kept open; and they are receiving half-pay. A dividend of 5 per cent. is recommended, in addition to the interim dividend already paid. The receipts for the year amounted to £104,242, and the expenditure to £72,722, leaving a profit of £31,520. The Directors say they are glad the report is so satisfactory, despite the competition of electric light and the heavy war taxation. The paid-up capital stands at £235,075, and the assets are valued at £408,043.

Bexhill Water and Gas Company.—The half-yearly meeting of the Company is being held to-day at the Cannon Street Hotel, E.C., when the Directors will report a balance at the credit of the profit and loss account available for dividend of £7869. They will recommend a dividend at a rate of £6 10s. per cent. per annum on the £34,000 of capital authorized by the 1885 and 1892 Acts, and at the rate of £4 11s. per cent. per annum on the capital of £123,710 authorized by their later Acts and Provisional Order. This, with provision for income-tax, will leave £3949 to be carried forward. The increase in the total revenue is considered to be satisfactory; but "the expenditure has been abnormally increased owing to the war and the rise in wages and the price of every commodity used by the Company." The Board propose to get the rescission of a resolution passed in 1908 regarding the increase of capital, and ask the shareholders to sanction the creation of £120,000 of new ordinary and preference capital—not more than half to be of the latter class.

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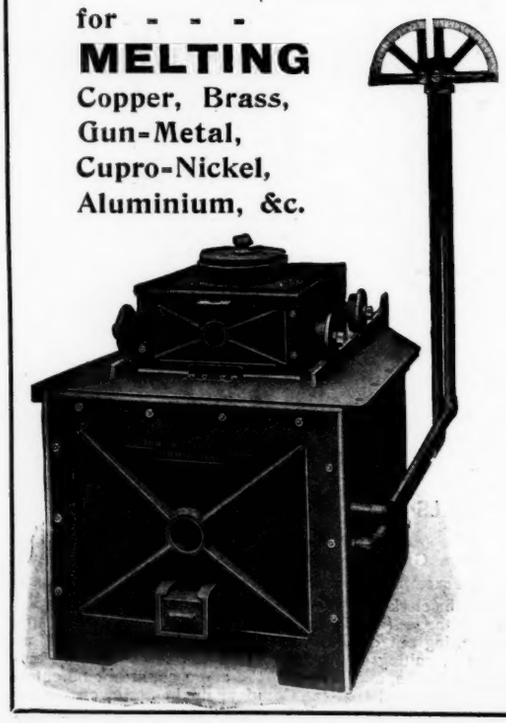

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DAVIS GAS-STOVE COMPANY, LIMITED.

The Sixteenth Annual General Meeting of the Company was held last Friday, at the Cannon Street Hotel, E.C.—Mr. H. ADDIS PRICE, the Chairman, presiding.

The CHAIRMAN, in moving the adoption of the report [*ante*, p. 651] and statement of accounts, said that, considering the circumstances, it was satisfactory that the Company were in a position to pay a dividend of 10 per cent. for the year on the ordinary shares. They had had a very strenuous and anxious year; the difficulties including, not only shortage of labour and the consequent necessity for paying increased wages, but continually increasing prices of all raw materials. They had certainly obtained enhanced prices for their goods; but these had not been nearly commensurate with the higher cost of production. This accounted to a very large extent for the diminution of profit compared with that of the previous year. The Directors, in addition to pensions paid to retired employees, had felt it their duty to contribute liberally to the suppert of the dependants of employees who have responded to the country's call for men; and in view of the fact that nearly £3000 has been expended for this purpose, he would ask them to set aside out of the profits for the year a further sum of £3000 to be placed to the credit of the provident fund. That there would be urgent calls upon this fund would be apparent, when he told them that practically one-half of the total number of the Company's regular male employees had joined the Forces. It would be noticed that the Directors had not this year made any allocation to the general reserve, which already stood at the substantial figure of £62,500, and was the equivalent of the preference share capital. In view of the present trade uncertainty, and the equally difficult times ahead, the Board had felt it wiser (after providing for the contribution of £3000 to the provident fund) to carry forward the whole of the remaining balance to the credit of the current year's profit and loss account.

Mr. HAROLD N. DAVIS (one of the Managing-Directors), in seconding the resolution, remarked that though it would not be prudent for him to give details of the munitions of war of which the Company had undertaken the manufacture, the shareholders might be interested to know that they had created several entirely new departments for this purpose—departments which they had every reason to believe they would be able to keep occupied in times of peace. In these departments, in addition to the men, they had some hundreds of women and girls employed, who had been trained in what before the war were considered skilled trades. The successful adoption of female labour had enabled the Directors to carry out, beyond the most sanguine expectations, their policy of releasing as many men as possible for the Army. There seemed to be an erroneous impression abroad that contracts for war material were yielding enormous profits; but people seemed to forget that the Ministry of Munitions comprised many of the ablest financial and business men of the country, and, whatever might have been the case in the earlier days of the war, for some time past contracts had been placed at prices which left the manufacturers a very small margin of profit. In saying this, he wished to pay a tribute to the Ministry of Munitions for obtaining what was required at the lowest possible cost to the country. The Company had for many years manufactured gas appliances for industrial purposes; but for some time past they had been carefully investigating new systems for the application of gas to such operations. They were now completing considerable extensions of the Industrial Appliances Department, which would enable them to cope with the rapidly growing demands for appliances constructed on the systems they had adopted. This branch of the business had been a fast expanding one; and it was one for which the Directors predicted a splendid future. The gas-stove section had been busily engaged during the year on large cooking and heating apparatus for military hospitals, camps, munition works, &c.; and the Company received the order to supply the whole of the gas cooking apparatus for the King George Hospital—the largest military hospital in the country. The staff had most loyally assisted the Directors in carrying on the business during the most difficult and arduous year in the Company's history.

The report was adopted, and a dividend making (with the interim payment) 10 per cent. for the year, less income-tax, was declared on the ordinary shares.

GAS AND METER TESTING IN LONDON.

There are contained in Vol. I. of the report of the London County Council for 1914, lately issued [four volumes are required to complete the report], particulars with regard to the tests of gas carried out during the twelve months. The results of the daily tests made at the official stations in the year ended Dec. 31, 1914, were:

Name of Company.	Average Illuminating Power (Standard, 14 Candles).	Average net Calorific Power.	Average Number of Grains of Sulphur in each 100 Cubic Feet of Gas.	Number of Statutory Deficiencies.
Gas Light and Coke .	14·24	120·4	33·6	20
South Metropolitan .	15·30	125·0	18·4	—
Commercial	14·45	120 2	30·3	1

Proceedings were taken against the Gas Light and Coke Company in respect of deficiency in illuminating power on twenty occasions. Forfeitures, amounting in all to £29, were incurred in three cases; and seventeen reports were cancelled. Proceedings were taken against the Commercial Gas Company in respect of deficiency in illuminating power on one occasion. The report was, however, cancelled. Results of tests made with the portable photometer were: Gas Light and Coke

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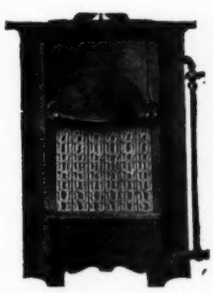

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Company, 31 tests, average 13·86 candles; South Metropolitan Company, 10 tests, average 14·63 candles; Commercial Company, 20 tests, average 12·95 candles; Wandsworth, Wimbledon, and Epsom Company, 10 tests, average 13·07 candles; Brentford Company, 10 tests, average 14·70 candles.

Under the provisions of the Gas Light and Coke Company's Act, 1914, which came into force on Jan. 1, 1915, the Company are no longer under any obligation to supply gas of a prescribed illuminating power. The standard illuminating power and also the standard calorific power prescribed in the Act of 1909 are replaced by a standard calorific power of 540 B.Th.U. gross [1 calorie = 3·97 B.Th.U.]; but the Company are not liable to forfeitures for deficient calorific power, unless it falls below 499·5 B.Th.U. on any one day. The tests for illuminating power by means of the flat-flame burner prescribed by the London Gas Act, 1905, are to be continued, and are to be made when the controlling authority directs; but the Company will not be liable to any penalty in respect of deficiency of illuminating power. The following are results of some tests of the net calorific power of the gas of the different Companies: Gas Light and Coke, 30 tests, average net calorific power, 119 4 calories; South Metropolitan, 10 tests, average 123·7 calories; Commercial, 20 tests, average 117 6 calories; Brentford, 10 tests, average 119·6 calories. In the case of the Wandsworth Company, 10 tests gave an average gross calorific power of 134·2 calories.

Under the Sales of Gas Acts, 1859 and 1860, and the Metropolis Gas Amendment Act, 1861, provision is made for regulating the measures to be used in the sale of gas, and for the appointment by the Council of inspectors to test meters in the County of London (excluding the City of London). The Council have four gas-meter testing offices. At each of these there is a senior inspector with a staff of assistants, who test all meters brought for the purpose; a fee being charged for each meter according to the scale fixed by the Act. The total number of meters submitted for testing during the year 1914 was 248,074, of which 208,518 were stamped and 39,556 rejected. In consequence of the large increase of the work during recent years, it has been found necessary during the year to put in hand the enlargement of the Newington gas-meter testing-office. The holders at the Westminster testing-office also were renovated and re-verified during the year.

Price Raised at Southend.—The Southend Gas Company announce that, in consequence of the advancing prices of raw materials, the charge for gas will be increased by 4d. per 1000 cubic feet from the next reading of the meters.

Rhymney and Aber Valleys Gas and Water Company.—It was stated at the annual meeting of the Company that, owing to the war, the new gas-works at Caerphilly would not be completed as early as had been expected; but it was hoped they would be quite finished by next winter. The revenue account showed a profit for the year of £18,518. A dividend of 5 per cent. was declared on the preference and ordinary shares.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *March* 27.

The position as regards pitch remains about the same as last reported. A fair amount of business continues to be done, both for home and export; and the price is steady at 19s. to 19s. 6d. per ton net at sellers' works. In other products, values are as follows: Creosote, 4d to 4½d. per gallon, in bulk; 90-160 solvent naphtha, 2s. 2d. per gallon, naked; 60's crude carbolic acid, 3s. 4d. per gallon, in sellers' tank trucks; pure toluol, 3s. 4½d. per gallon, naked; pure benzol, 1s. 7d. per gallon, naked—all at makers' works, net cash. The last mentioned three products are, of course, entirely under Government control.

It is reported that export licences for sulphate of ammonia will now be granted more freely; the farmers not having taken the large quantities anticipated by the Government. With the more general resumption of exports, a firmer tone is to be expected. Stocks are not unduly large, as shipments made against old licences in hand have tended to keep these within reasonable limits. The prompt value of 25 per cent. quality is £17 5s. per ton net, into buyers' bags, at makers' works.

Tar Products in the Provinces.

March 27.

There is no alteration in the markets for tar products. Creosote is still quiet, and business is very difficult in this article. There appears to be a great deal of solvent naphtha offering. Heavy naphtha is in good demand.

The average values of gas-works products during the past week were: Gas-works coal tar, 16s. to 20s. Pitch, East Coast, 15s. to 15s. 6d. per ton; West Coast, 14s. to 14s. 6d. Manchester; 15s. to 15s. 6d. Liverpool; 17s. to 17s. 6d. Clyde. Benzol, 90 per cent., North, 10½d. to 11⅛d.; 50-90 per cent., naked, North, 1s. 3d. to 1s. 4d. Toluol, naked, North, 2s. 3d. Coal tar crude naphtha, in bulk, North, 6½d. to 7d. Solvent naphtha, naked, North, 2s. Heavy naphtha, naked, North, 1s. 2d. to 1s. 3d. Creosote, in bulk, North, 2⅛d. to 2⅜d. Heavy oils, in bulk, 3⅞d. to 4d. Carbolic acid, 60 per cent., East and West Coasts, 3s. 4d. naked. Naphthalene, £18 to £28; salts, 80s., bags included. Anthracene, "A" quality, 2d. to 2½d. per unit; "B" quality, nominally ⅜d.

Sulphate of Ammonia in the Provinces.

LIVERPOOL, *March* 25.

During the past week there has been no new feature to comment upon in the market for this article, and only slight fluctuations have taken place in values. The inquiry has been less than it was last week, but there has not been much pressure on the part of producers to effect

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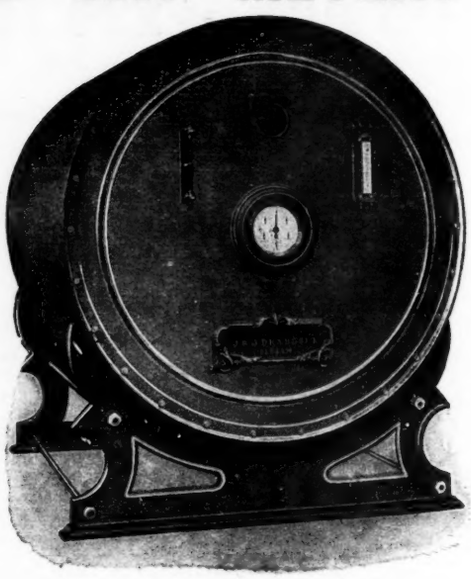

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sales. At the close the quotations are still £16 17s. 6d. per ton f.o.b. Hull, £17 f.o.b. Liverpool, and £17 2s. 6d. f.o.b. Leith. The forward position has remained quiet, but it has transpired that a little business has been done for April-September delivery at a premium on prompt prices.

Nitrate of Soda.

The spot market for this material has been well maintained, and prices are now 17s. 3d. per cwt. for ordinary, and 18s. 3d. for refined quality.

Sulphate of Ammonia.

From another source it is stated that outside London makes are quoted at £15 17s. 6d.; Hull, 16 12s. 6d.; Liverpool, £16 15s.; Leith, £16 17s. 6d.; Middlesbrough, £16 15s. 6d.

COAL TRADE REPORT.

Northern Coal Trade.

Though steamers are still scarce, yet there is a fairly good shipment of coal from the north-eastern ports, and there is also a very strong demand for most classes of fuel. This fuller export has had the effect of stiffening the prices, though this is more shown for the forward supplies. In the steam coal trade, prompt supplies are not so easy to obtain, and values are well maintained. Best Northumbrian steams are steady at 32s. 6d. to 34s. 6d. per ton f.o.b.; second-class steams are about 29s. to 30s. per ton; and for steam smalls the prices are firm at 16s. to 20s. per ton. The production is good when the depleted staff at the collieries is borne in mind, as well as the considerable amount of short time that is being worked—partly unavoidable. In the gas coal trade, requirements are still heavy, and the output is readily taken up, though the consumption must now be decreasing as the days lengthen. For best Durham gas coals, about 25s. 6d. per ton f.o.b. is the current price; for second-class gas coals, 24s. per ton; while "Wear Specials" are 27s. per ton f.o.b. In a few instances, where prompt steamers have been found, slightly less may have been taken; but the market seems steadier. A little is being done in contracts. The details, however, do not readily transpire; and they are not expected to vary much from the prices under parliamentary enactment. The high freights continue. Gas coal from the Tyne to London is nominally about 16s.; and to Genoa, it is close upon the record rate of £5 per ton. At the same time, much coal is being carried under lower rates, previously arranged; but tonnage is scarce, and much of that supplied is that of neutral steamers. Coke is steady, with a good demand. Gas coke seems to show a little ease, though the exports are tolerably full. Good gas coke is now quoted from 26s. 6d. to 28s. per ton f.o.b. in the Tyne.

Auckland (N.Z.) Gas Company, Limited.

The report adopted at the fifty-fourth annual meeting of the Company, held last month, stated that the profit for the twelve months ended Dec. 31, after deducting working expenses, cost of repairs and renewals, management expenses, interest, and other charges, amounted to £61,837. Adding the balance in hand, and deducting the interim dividend paid in July, there was an available sum of £64,935, out of which the Directors recommended the payment of a dividend for the past half year of 11d. per share on the £1 fully-paid shares, and a proportionate amount on the £1 contributing shares (7s. paid). The Chairman (Mr. J. H. Upton) said the accounts were such as to entitle the shareholders to congratulate themselves on the year's operations. General charges were more, owing to the fact that they had subscribed £2000 to the patriotic fund, and £250 to the hospital ship. For the first time in many years, the sale of gas showed only a slight increase; but there had been a large increase in the number of consumers. The obvious inference was that general economy in expenditure was being practised by the people. The price of gas in Auckland was the lowest in New Zealand, and except in Sydney the lowest in Australasia. Of the staff, 47 had responded to the greatest call that could be made on any of them, and had volunteered for service against the enemy. The Directors sincerely hoped they might all come back; and should this be their good fortune, they would find a warm welcome, and their old positions, or better ones, open for them. The Company had now taken the sale of coke to the public into their hands, and were selling more than they made, so that the stocks were being steadily reduced.

Middlesbrough Gas Supply.—At a meeting of the Middlesbrough Corporation Gas Committee last Tuesday, it was stated that the gross estimated profit on the gas-works for the past year was £22,502. It was also reported that, for the first time for nearly eighteen months, there had been an increase in the consumption of gas. The amount sent out during February was 45,565,000 cubic feet, which was an increase of 3,350,000 feet.

Monte Video Water-Works Company.—The Directors' report for the year 1915 states that the net receipts amounted to £120,492, or £2805 more than in the preceding year. The payment is proposed of a final dividend of 5 per cent., making 8 per cent. for the year, less income-tax. After allocations to the reserve, depreciation, and staff provident funds, there will be a balance to carry forward of £56,543. The ratio of working expenses during the year was 33·1 per cent., as against 33·75 per cent. in 1914. The Directors point out, however, that it will be difficult to prevent an increase in the ratio during the current year, owing to dearer fuel and materials, and local legislation restricting the hours of labour. The severe crisis in Monte Video has recently shown signs of diminishing, with the result that the Company's business has expanded, and the revenue been maintained.

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Broadstairs Gas Company.

At the annual meeting of this Company last Thursday week unusual interest was shown in the proceedings, undoubtedly due to the reduction in the profits for 1915 notwithstanding that the price of gas was 9d. higher for a great part of the period under review. After the usual preliminaries, the Chairman introduced the report and accounts. Mr. R. W. Edwards, of Aldershot, moved an amendment that the report should not be adopted, and that the meeting should be adjourned, and a Committee of Shareholders appointed to investigate the affairs of the Company, with power to engage the services of an expert at a fee not exceeding fifty guineas in due course, and submit a report to the shareholders. This amendment was lost; whereupon a motion was proposed that the dividends recommended in the Directors' report be not paid. This was carried. In the discussion on the report, several matters of vital importance were revealed, which a section of the shareholders still think must be further looked into and a general reorganization of the Company's affairs effected. It is possible, we learn, that a body of shareholders may take further action unless the Board agree to a radical reorganization, which can only be effected by securing an expert's advice and introducing suitable reforms. Two new Directors, known locally, were elected to the Board.

Dublin Gas Company v. Blackrock Council.—A meeting of the Blackrock (co. Dublin) Urban District Council have considered threatened legal proceedings by the Alliance and Dublin Consumers' Gas Company, respecting their agreement for the public lighting of the township. After a discussion in committee, a recommendation was adopted that the Law Agent be instructed to enter an appearance on the writ served by the Company.

Price of Gas at Hebden Bridge.—A proposal to consider the question of advancing the price of gas to consumers was brought forward at a meeting of the Hebden Bridge and Mytholmroyd Gas Board last week—Mr. James Simpson, J.P., in the chair. Immediately the matter had been raised, it was moved and seconded that the question should be discussed in committee. Mr. B. Grindrod disagreed. He thought the time had come when the public should know more of the difficulties the Board had to face. In view of the increased cost of material, it was thought by those who understood gas manufacture that for every shilling put on coal the price of gas should be increased one penny. In his opinion, the time had come when the Board should put up the price of gas. Mr. A. Sutcliffe stated that he had no fear as to publicity, but he did not consider the present an opportune time to increase the price. They should at least wait until the end of the financial year, and see how they stood, before deciding anything. He was opposed to any advance at present. The resolution for privacy was carried. In committee, however, a motion to advance the existing rate of 3s. per 1000 cubic feet for ordinary consumers, and a graduated lower scale for power purposes, was defeated.

Halifax Municipal Trading Profits.—A statement of profits on municipal undertakings during the past year, submitted to the Halifax Town Council, showed that the total on all the trading undertakings was £53,058, of which £22,689 was paid by the gas-works. The electricity undertaking contributed only £14,353. Owing to the darkening of the streets, it was mentioned, £5742 was saved on public lighting.

Gillingham Corporation Electrical Undertaking.—The following reference to the electrical undertaking of the Gillingham Corporation appears in the "Chatham, Rochester, and Gillingham Observer:" It cannot be said that the estimates with regard to the electric light undertaking make pleasant reading. The repayment of principal and interest during the ensuing six months will absorb £3659, expenditure on coals and other bills £2660, rates, taxes, &c., £22, and salaries and wages £1375—making a total of £7716. Against this the income is estimated at £4154, leaving a deficit of £3562 to be met from the rates. This is practically equivalent to a 5d. rate. In other words, the non-users of the electric light have to bear a large proportion of the cost of producing the current. The position is far from satisfactory. At the present rate of progress many years must elapse before the undertaking gets to the self-supporting stage. Those who were responsible for the purchase of the works anticipated that in the course of a few years a profit would be shown; but such a rosy view has been entirely falsified. It need hardly be said that had a private company been running the undertaking on precisely similar lines it would have been in bankruptcy long ago."

Lord Provost of Edinburgh on "Salesmanship."—Last Friday, the Lord Provost of Edinburgh (who is Chairman of the Gas Commissioners) gave an interesting address on "Salesmanship" to a meeting of the Edinburgh and East of Scotland Association of Goldsmiths, Silversmiths, and Watchmakers. The vital part of business, he remarked, was the sale. The method of selling which was the most economical, progressive, successful, and profit-making was the one which should be used. The successful salesman must be inwardly and outwardly in harmony with the goods he sells. The temperament of the customer had to be considered. Diplomacy in speech was always to be commended till the salesman knew his customer; thereafter he would naturally adopt the attitude which would appeal to the temperament of the customer. Many a salesman was a failure because he was not adapted to his work. "Bluff" might be part of salesmanship; but everlasting "bluff" never made a salesman successful. Customers liked to be waited on, and demanded some flattery. Essentials were judgment, memory, desire to serve, honesty, truth, enthusiasm, tact, decision, and action. A glib tongue was apt to breed suspicion. Salesmanship was the power to persuade people to purchase at a profit. The salesman was not only born but made; and the successful salesman was the man of thought, culture, and usually of study. He had always found he could do business with Americans because he tried to kill them with kindness.

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Devon Gas Association.

The tenth annual meeting of the Association was held last Thursday, at Exeter. The Chairman (Mr. F. Templer Depree, J.P.), in moving the adoption of the report, said the past year had been one of exceptional difficulty to all gas companies. In their case, the price of coal had increased at least 40 per cent. over the average price for the previous five years, which, in itself, was a formidable difficulty. It had been met, to a small degree, by an increase in the price of gas; and he thought the shareholders would be quite agreeable to sharing with the gas consumers a portion of the burden, by accepting 4 per cent. dividend, instead of the 5 per cent. they had hitherto received. The difficulty in disposing of tar, and the Government ban on the sale of crude tar, had occasioned a decrease in the revenue; but the Company hoped to meet this by the erection of a small dehydration plant, which would render the tar saleable for road purposes, and enable them to extract the light oils necessary for high explosive purposes. The outlook was uncertain; but he felt assured that the ultimate prospects of the Association could be looked forward to with every confidence. Mr. R. J. Rew seconded the motion; referring to the improved working results, and expressing the opinion that 5 per cent. would be paid again on the return to normal times. The report was adopted.

A Badged Gas Stoker and the Tribunal.

Correspondence which had passed between the Ministry of Munitions, the Shotley Bridge Gas Company, and the Benfieldside Tribunal, relative to the case of a gas stoker who had been refused exemption, was read at a sitting of the Tribunal last week. In reply to a letter from the Gas Company drawing attention to the case, the Ministry said the Company had made a great mistake in allowing their badged employees to go before the local tribunals. Fox was exempted by his badged certificate, in spite of the decision of the Tribunal; and if he received a notice paper summoning him to the Colours, the Ministry's instructions should be followed out exactly. Mr. J. B. Lazenby (Clerk to the Tribunal) had explained in a letter to the Ministry that, prior to December, the man was in a situation as a groom; but when he left that place, he became a gas stoker. The Tribunal thought, rightly or wrongly, that the Gas Company ought to, and could, if they liked, get a man over military age to do stoking work. The Ministry of Munitions, in a further letter, said that as the man was badged, his certificate of exemption could only be withdrawn by the Ministry, and suggested that the military representative should apply for a review of the certificate. The military representative said he would take the matter up with the Ministry.

Reduction in Price at Bo'ness.—At Bo'ness, the price of gas has been reduced from 3s. 9d. to 3s. 4d. per 1000 cubic feet. The consumption of gas during the past eight months has increased; and this has led to the present reduction.

Wrexham Gas Company.

It was stated by the Chairman (Mr. J. Oswell Bury), at the annual meeting of the Company, that it was proposed to increase the price of gas a further 3d. per 1000 cubic feet, making the net charge 2s. 9d. Since the beginning of the war, the price of coal had increased more than 35 per cent., lead pipe 78 per cent., wrought-iron tube 41 per cent., copper goods 60 per cent., brass fittings 50 per cent., burners 50 to 60 per cent., and glass, in some cases, 150 per cent. One effect of the increase in the price of gas was the automatic decrease in the bonus payable to the employees under the co-partnership scheme; and this the Directors greatly regretted. Revenue receipts showed a total increase of £3467, compared with 1914; the total being £26,737. The increased sale of gas (due principally to billeting in the district) was equal to nearly 12 per cent. Expenditure on revenue account was £21,636, as against £18,161. The total sum available for dividends was £9162. Fourteen of the employees were serving their country, as well as one of the Directors; and every man of military age with the Company had attested. Under the "free labour" system of burner maintenance, nearly 58,000 burners were attended to last year. To replace losses, two young women had been engaged for maintenance work, with satisfactory results. The report having been adopted, a dividend at the rate of 2½ per cent. for the half year was declared, making 5 per cent. for the year.

Torquay Gas Company.—The annual meeting of the Company was held last Thursday week—Mr. A. Iredale presiding. The report submitted stated that there was a credit balance of £9679. The Chairman referred with satisfaction to the fact that Mr. R. P. Kitson, who presided over the meetings prior to the war, had been promoted to the rank of Major. They had, he said, had a record year, both in the matter of income and expenditure. Coal had cost them £18,299, against £14,720 in 1914, an increase equal to 31 per cent. They had received £1000 more from coke; and the revenue from the sale of gas had increased from £25,427 to £30,539. The report was adopted.

North Shore (Sydney) Gas Company.—That the business of the Company during the past year had in some respects been fairly satisfactory, was the comment of the Chairman (Mr. P. T. Taylor) at the recent annual meeting. Instead of the rate of increase being, as in former years, from 12 to 15 per cent., it had fallen to 3·61 per cent.; and there were indications that during the present year the output of gas would not be so much as that of last year. About eighty men, including six from the office staff, had joined the Colours. The construction of the Oyster Cove works was being proceeded with; but, unfortunately, owing to the war, certain portions of the work were at a standstill. The total number of consumers was 17,525; and the output of gas last year was 724,482,394 cubic feet. After the report had been adopted, dividends were declared for the half year at the rates of 3½ per cent. on the "A" shares and 3 per cent. on the "B" shares, making 6½ and 6 per cent. for the year.

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Increase at Huthwaite.—Following the example of many other Nottinghamshire authorities, the Huthwaite Urban District Council at their meeting last Tuesday, decided to raise the charge for gas to ordinary consumers 6d. per 1000 cubic feet. The prepayment meters are to be altered so that less gas will be given for a penny.

Increase in Price at Hull.—Public announcement has been made by the British Gaslight Company, at Hull, that the price of gas, in consequence of the greater cost of production, will be raised to 2s. 4d. per 1000 cubic feet from the end of the present quarter. This is the second advance of 3d. made since the outbreak of the war; the pre-war price having been 1s. 10d. per 1000 cubic feet.

Financial Results of the Panama-Pacific Exposition.—In the current month's number of the "American Gas Institute News" the Secretary (Mr. George G. Ramsdell) remarks: The Panama-Pacific Exposition, for probably the first time in history, reversed the usual custom and closed with a surplus instead of a deficit. The gas industry may well feel proud of the fact that the "Collective Gas Exhibit" followed the lead of the exposition, and also closed with a surplus of $311·53. The Gas Exhibit Committee unanimously voted that any surplus funds should be equally divided between the American Gas Institute and the Pacific Coast Gas Association; and the balance referred to has now been handed over.

Nottingham Gas Undertaking.—The substantial part which the Nottingham gas undertaking has played in the alleviation of municipal burdens was pointed out by Alderman Sir John Turney at a special meeting of the Corporation on Monday of last week, when the honorary freedom of the city was bestowed upon him, accompanied by the gift of a silver casket, in recognition of his services to the Municipality. Sir John, who has been a member of the Council for over 42 years, covering a period of the city's greatest development, recognized the soundness of the bargain which was effected when the gas-works were acquired. Alluding to the large capital outlay upon the principal trading undertakings, he characterized the gas concern (which was acquired for what he deemed the reasonable sum of £1,186,000) as having always been a good paying investment, and well managed.

Gas Supply of Newcastle (N.S.W.).—The accounts of the Company for the last half of 1915 showed a net profit of £9078, making a total for the twelve months of £17,983. Out of an available surplus the Directors recommended dividends at the rates per annum of 7 and £4 18s. per cent., leaving a carry forward of £4281. The paid-up capital was £263,844. At the half-yearly meeting, the Chairman (Mr. J. R. Hall) pointed out that the rate of dividend was far below that sanctioned by the Gas Act, at the price at which gas was being sold by the Company. It was quite possible that application would have to be made to the Necessary Commodities Control Commission for permission to increase the price, especially in view of the recent advance in the cost of coal. The output of gas showed a satisfactory increase. Recently the laying of more than 10 miles of mains at Stockton had been completed; and they had been connected with those on the Newcastle side by means of a submerged main across the entrance to the harbour—an arduous task. The report was adopted.

Water Supply of Newcastle and Gateshead.—In his remarks to the stockholders at the annual meeting of the Newcastle and Gateshead Water Company, the Chairman (Mr. J. C. Hamilton) said that, compared with the previous year, the revenue from all sources had increased by £12,306, while the working expenses had advanced by £4247, being at the rate of 25·85 per cent. on the gross revenue, as compared with 25·37 per cent. for the previous year. In view of the available balance at the disposal of the Company, the Directors had taken the opportunity to deal with the depreciation of meters. Meters were, of course, of a perishable nature; and although kept up and renewed out of revenue, very old meters became obsolete. They had, therefore, written-off the sum of £4000 towards a depreciation fund, which would have to be added to from time to time until the expenditure on meters was brought down to the present value, as shown by the stock sheets. The net revenue, after this deduction, amounted to £169,949, as compared with £165,890 a year ago. Additional interest, through the enhanced value of money, had had to be paid during the year on temporary loans. After providing for this and the dividends to be declared, there would be a balance to carry forward of £15,675, which was £4334 more than last year. Bearing in mind the times through which they were passing, he hoped they would consider the proposed dividend—which aggregated 8½ per cent. for the year on the original stock, and £5 19s. per cent. on the 7 per cent. maximum stock, while at the same time it had been found possible to improve the Company's financial position—highly satisfactory.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for March 22.]

Nos. 3680—4078.

BARRALET, T. E.—"Thermostats for water-heaters." No. 3890.
DRAKE, J. W.—"Controlling draught on furnaces." No. 3947.
DRAKES LIMITED.—See Drake. No. 3947.
FORSTER, J. D.—"Prepayment meters." No. 3727.
GLOVER, S.—"Discharging vertical retorts." No. 3731.
HAMLYN, W. R.—"Stills for tar." No. 3960.
HAULT DE LASSUS, F. DE.—"Mantles." No. 4058.
KERSHAW, H.—"Inverted burners." No. 3820.
LEGAT, A. S.—"Gas-cookers and boiling-rings." No. 4047.
METROPOLITAN GAS-METERS LIMITED.—"Prepayment meters." No. 3727.
METROPOLITAN GAS-METERS LIMITED.—"Locks and keys." No. 3728.
PARKINSON STOVE COMPANY.—See Barralet. No. 3890.
RITER-CONLEY MANUFACTURING COMPANY.—"Producing sulphate of ammonia." No. 4000.
ROOTS, J. D.—"Incandescent mantle lamps." No. 3981.
SHACKLETON, J.—"Flame-spreaders for gas-lights." No. 3939.
WEST, J.—See Glover. No. 3731.

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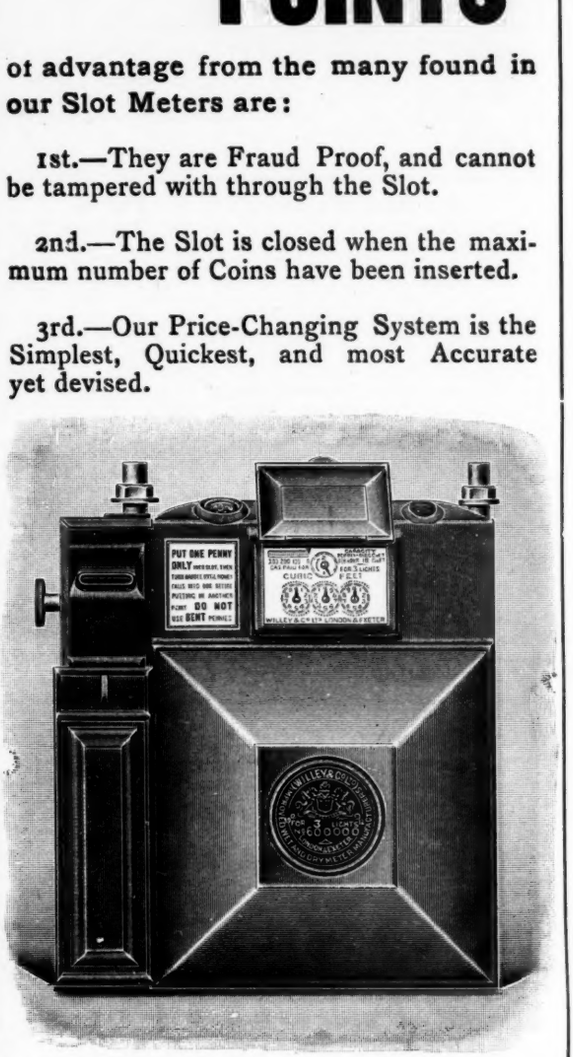

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Lurgan Gas-Works Purchase.—At a special meeting of the Lurgan Town Council, it was agreed to sign authority for the payment of £41,544 in favour of the Lurgan Gas Light and Chemical Company, Limited—being £40,000 for the purchase of the undertaking, together with an expenditure on capital account of £582, and the purchase of stores, £962.

Advance in Price Cancelled at Barnard Castle.—At the annual meeting of the Barnard Castle Gas Company, the Chairman (Mr. R. T. Richardson) presented the report, which showed an increase in the sale of gas to ordinary consumers, and a substantial gain in the revenue from residuals. The Cotherstone consumption had progressed satisfactorily; and a statement prepared by the Secretary (Mr. R. Wood) showed that the original estimate by their Consulting Engineer (the late Mr. Joseph Hepworth) had already been exceeded. A satisfactory feature was the withdrawal of a notice given in December that an advance of 2d. per 1000 cubic feet would be made in the price of gas, as from Jan. 1. The financial statement showed a balance of £1254 on the year's working. It was decided to pay a dividend for the half year at the rate of 6 per cent. per annum on the original consolidated stock and £4 5s. 8d. per cent. on the new ordinary stock, free of income-tax. A sum of £1133 is carried forward.

Ripon Gas-Works Extensions.—It is stated that the Ripon City Council have decided to drop a proposed electricity scheme, and to proceed with a scheme prepared by Mr. J. Wilfrid Dunn for the extension of the gas-works.

Gas or Electricity for Camp Lighting.—The Army Council having declined the offer of the Bridge of Allan Town Council to supply gas for the Hutment Camp at Cornton, the Clerk was instructed to appeal to Dr. W. A. Chapple, M.P., to continue his support of the proposal to use gas instead of electricity at the camp. The Secretary of the War Office now states that the Army Council have referred the question of the lighting of the camp to the General Officer, Commanding-in-Chief, Scotland, for reconsideration.

Another Increase in Price at Walton-on-Thames.—Intimation is made by the Directors of the Walton-on-Thames and Weybridge Gas Company that, owing to the enormous increase in the cost of coal, brought about by the unprecedentedly high freights, they are compelled to raise the price of gas 4d. per 1000 cubic feet as from the beginning of next quarter. This will make the charge 4s. 3d. per 1000 cubic feet, which compares with a figure of 3s. 6d. up to about a year ago, when there was an advance of 5d. per 1000 feet.

STOCK MARKET REPORT.

THE state of things on the Stock Exchange underwent a noteworthy improvement last week; and the accelerated activity of markets, coupled with a very cheerful tone, quite revived the drooping spirits of members who for so long have found little to do. The public dropped their veil of hesitation, and showed themselves ready to embark not only in solid investments, but in more speculative and exciting lines. And in response to demands where the supply of stock was low, many prices advanced freely. In Government issues, the War Loan and Consols opened and closed strong. A momentary check was experienced, ascribed to the lowering by the Government of Treasury Bill rates, which might divert money into Exchequer Bonds; but this was soon cured. The much-tried Home Rails market had quite a gratifying recovery. Confident expectations regarding the future were entertained, and prices hardened daily. Americans were depressed; the Mexican trouble being a dark cloud there was no seeing through. Canadians bore up only moderately against the influence, in spite of their internal strength. In the Foreign Market, the salient feature was the steadiness of the French loan. South Africans had a good week, though latterly steadied by the inevitable realization of profits. In the Miscellaneous Market, there was much activity, and some lines were very strong—rubber and oil being conspicuous in the van. The Money Market was rather quiet on the whole, but rates in general pointed in the upward direction. Topics of interest were not numerous. The Government, having at length settled their scheme for borrowing Dollar securities with rights of purchase, made an announcement of its terms, and the same are attracting criticism. The Exchequer returns for the previous week are favourable and encouraging. The election of the new Stock Exchange Committee is regarded with satisfaction by the Anti-German Union. The Directors of the Baltic Shipping Exchange are going to deal with alien enemy members on lines similar to those of the Stock Exchange Committee. Business in the Gas Market was very quiet, and no features of interest were presented. Prices showed practically no change.

Bargains done for cash during the week were as follows: On Monday, Gas Light ordinary 72⅜, ditto preference 74½, Portsea "C" 104, Primitiva preference 3 11/16. On Tuesday, Gas Light ordinary 72⅜, 72½, 72⅜, 73, Imperial Continental 60½, 60¼, Portsea "C" 103½, Primitiva 2, 2 1/32, 2 1/16, 2⅛, South Metropolitan 75, 75¼, 75⅜. On Wednesday, Continental Union 38⅜, Gas Light ordinary 72, 72¼, 72½, Imperial Continental 60¼, Liverpool 87⅛, Primitiva 2⅛, ditto preference 3 9/16. On Thursday, Brentford "A" 84⅛, 84⅜, British debenture 70, Gas Light ordinary 72½, ditto debenture 59⅜, 60, Imperial Continental 59½, 59⅜. On Friday, Gas Light ordinary 72¼, 72⅜, 72⅜, Primitiva 2 9/16. On Saturday, Commercial 4 per cent. 72, ditto 3½ per cent. 69, ditto debenture 56, Gas Light ordinary 72½, 72⅜, 73, Imperial Continental 59, South Metropolitan 75½, ditto debenture 60½.

The Bank rate is 5 per cent.—as fixed on Aug. 8, 1914.

The Darlington General Purposes Committee have decided that all men employed at the gas-works shall have the war bonus scale amended so as to provide for an increase of 1s. per week to each.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue.	Share.	When ex-Dividend.	Previous Div or Dividend & Bonus.	Last Dividend.	NAME.	Closing Prices. July 30, 1914.	Yield on Highest Closing Price.	Lowest and Highest Prices of Bargains.
£			p.c.				£ s. d.	
1,551,868	Stk.	April 8	2½	5⅛	Alliance & Dublin Ord.	59—64	8 18 2	..
874,000	,,	July 10	4	4	Do. 4 p.c. Deb.	76—79	5 1 3	..
280,000	5	April 29	7½	3/-	Bombay, Ltd. . . .	5⅛—6⅜	5 17 8	..
50,000	10	Feb. 26	16	15/-	Bournemouth Gas and Water { 10 p.c. .	99—90	5 6 8	..
339,110	10	,,	7	7/-	B 7 p.c. .	15—15½	4 10 4	..
115,000	10	,,	6	6/-	Pref. 6 p.c.	13½—14	4 5 9	..
157,740	—	—	—	4	4 p.c. Deb.	..	—	..
992,045	Stk.	Feb. 26	†14	£6/-	Brentford A Consold. .	261—266	5 5 8	84⅛—84⅜
734,920	,,	,,	†11	55/-	Do. B New . .	204—209	5 5 8	..
55,000	,,	,,	5	5	Do. 5 p.c. Pref. .	109—111	4 10 1	..
221,400	,,	June 11	4	4	Do. 4 p.c. Deb. .	91—98	4 6 0	..
217,880	Stk.	Feb. 26	11	10⅜	Brighton & Hove Orig.	208—213	5 8 4	..
344,300	,,	,,	8	7⅜	Do. A Ord. Stk. .	154—159	5 0 8	..
590,000	20	Mar. 26	13½	22/6	British	44—45	5 11 1	..
120,000	Stk.	June 26	4	4	Do. 4 p.c. Deb. Stk.	88—90	4 8 11	70
245,771	Stk.	June 26	4	4	Buenos Ayres 4 p.c. Deb.	85—87	4 12 0	..
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½—2½	—	..
100,000	10	—	—	4/6	Do. 4½ p.c. Pref. .	4—6	—	..
100,000	Stk.	June 26	4½	4½	Do. 4½ p.c. Deb. Stk.	70—75	6 0 0	..
157,150	Stk.	Feb. 26	5	5	Chester 5 p.c. Ord. .	108—110	4 10 11	..
1,513,280	Stk.	Feb. 12	5/9/4	49/4	Commercial 4 p.c. Stk.	106—108	5 1 2	73
560,000	,,	,,	5⅛	46/8	Do. 3½ p.c. do. .	103—105	5 1 6	69
475,000	,,	June 11	3	3	Do. 3 p.c. Deb. Stk.	69½—71½	4 3 11	56
800 000	Stk.	,,	4	4	Continental Union, Ltd.	76—79	5 1 3	38⅛
200 000	,,	,,	7	7	Do. 7 p.c. Pref.	115—118	5 18 8	..
278,400	,,	—	—	11½	Croydon B and C 7 p.c.	..	—	..
492,270	Stk.	—	6	6½	Derby Con. Stk. . .	123—125	4 16 0	..
55,000	,,	—	4	4	Do. Deb. Stk. .	102—104	3 16 11	..
1,002,180	10	July 29	10	10/-	European, Ltd. . . .	17½—18	5 11 1	..
16,327,185	Stk.	Feb. 10	4/17/4	42/-	Gas Light and Coke { 4 p.c. Ord. .	98—102	4 15 6	72—73
2,600,000	,,	,,	3½	3½	3½ p.c. max. .	76—79	4 8 7	..
4,062,235	,,	,,	4	4	4 p.c. Con. Pref.	96—99	4 0 10	74½
4,674,850	,,	June 11	3	3	3 p.c. Con. Deb.	72½—74½	4 0 6	59⅜—60
130,000	,,	,,	10	10	10 p.c. Bonds .	..	—	..
258,740	Stk.	Mar. 12	5	4½	Hastings & St. L. 3½ p.c.	87—89	5 12 4	..
70,000	10	April 29	11	6	Hongkong & China, Ltd.	16½—16¾	6 11 4	..
86,600	—	—	—	9½	Hornsey 7 p.c. . . .	..	—	..
131,000	Stk.	Mar. 12	7⅛	7⅛	Ilford A and C . . .	151—154	5 2 4	..
65,780	,,	,,	6⅜	5⅞	Do. B	115—118	5 8 0	..
65,500	,,	June 26	4	4	Do. 4 p.c. Deb. . .	92—94	4 5 1	..
4,940,000	Stk.	May 14	9	4½	Imperial Continental .	150—160	5 12 6	59—60½
1,235,000	Stk.	Feb. 12	8½	8½	Do. 8½ p.c. Deb. Red.	84—86	4 1 5	..
235,942	Stk.	Mar. 12	6½	6½	Lea Bridge Ord. 5 p.c. .	119—121	5 7 5	..
2,198,905	Stk.	Feb. 26	10	5	Liverpool 5 p.c. Ord. { A	211—213	4 13 11	87½
					{ B	146—148	4 14 7	
306,083	,,	June 26	4	4	Do. 4 p.c. Pr. Deb. Stk.	..	—	..
75,000	5	June 11	6	2/-	Malta & Mediterranean	4½—4⅝	6 9 9	..
250,000	100	April 1	4½	4½	Met. of Melbourne { 4½ p.c. Deb.	99—101	4 9 1	..
541,920	20	May 28	4	6/-	Monte Video, Ltd. . .	11½—12	6 18 4	..
1,375,892	Stk.	July 29	4½	4½	Newc'tle&G'tesh'd Con.	98½—99½	4 10 6	..
529,705	Stk.	June 26	3½	3½	Do. 3½ p.c. Deb.	82—88	4 4 10	..
55,940	10	Feb. 26	7/14/0	7/8/2	North Middlesex 7 p.c.	14—15	5 2 8	..
800,000	Stk.	May 14	8	8	Oriental, Ltd. . . .	117—122	6 11 2	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd. . . .	7½—7⅞	6 9 0	..
60,000	50	Feb. 26	12	65/-	Portsea, Island B . .	128—131	4 19 8	..
100,000	50	,,	12	60/-	Do. C . .	118—121	4 19 2	103½—104
52,000	50	,,	10	—	Do. D . .	..	—	..
249,980	5	April 29	8	—	Primitiva Ord. . . .	5½—6	6 13 4	2—2 3/32
499,960	5	June 26	5	2/6	,, 5 p.c. Pref. .	4½—5	5 0 0	3 5/16—3 11/16
521,600	100	June 2	4	4	,, 4 p.c. Deb. .	91—93	4 6 0	..
—	—	—	—	4	,, ,, ,, 1911	..	—	..
846,198	Stk.	June 26	4	4	River Plate 4 p.c. Deb.	85—87	4 12 0	..
150,000	10	May 14	6	6/-	San Paulo { 6 p.c. Pref.	10½—11	5 9 1	..
125,000	50	July 1	5	5	5 p.c. Deb.	47—49	5 2 0	..
135,000	Stk.	Mar. 12	10	10	Sheffield A	223—224	4 9 8	..
209,984	,,	,,	10	10	Do. B	222—224	4 9 8	..
523,500	,,	,,	10	10	Do. C	220—222	4 10 1	..
90,000	10	May 28	9	6/-	South African . . .	10½—11½	7 16 6	..
6,609,895	Stk.	Feb. 10	5/4/0	44/-	South Met., 4 p.c. Ord.	111—113	4 16 8	75—75⅜
1,895,445	,,	July 10	3	3	Do. 3 p.c. Deb.	72½—74½	4 0 6	60½
224,820	Stk.	Feb. 26	8½	8	South Shields Con. Stk.	157—159	5 6 11	..
952,795	Stk.	Feb. 26	6	48/4	S'th Suburb'n Ord. 5 p.c.	114—116	5 3 5	..
60,000	,,	,,	5	5	Do. 5 p.c. Pref. .	110—112	4 9 8	..
135,000	—	—	—	48/4	Do. West Kent. .	..	—	..
187,558	,,	June 26	5	5	Do. 5 p.c. Deb. Stk.	116—118	4 4 9	..
629,740	Stk.	May 14	5	5	Southampton Ord. . .	99—102	4 18 0	..
120,000	Stk.	Feb. 12	7½	7½	Tottenham District { A 5 p.c. .	135—138	5 8 8	..
782,275	,,	,,	6	6	B 3½ p.c. .	115—117	5 2 7	..
181,255	,,	June 26	4	4	4 p.c. Deb.	87—89	4 9 11	..
189,380	10	Dec. 30	5	—	Tuscan, Ltd.	5—6	8 6 8	..
149,900	10	July 1	5	5	Do. 5 p.c. Deb. Red.	93—95	5 5 3	..
236,476	Stk.	Mar. 12	5	5	Tynemouth, 5 p.c. max.	103½—109½	4 11 4	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	Stk.	Feb. 26	8⅜	78/9	Wandsworth A 5 p.c.	151—156	5 7 4	..
255,636	,,	,,	6⅜	63/9	,, B 3½ p.c.	129—134	5 3 7	..
108,075	,,	,,	5/17/8	55/1½	,, C 3½ p.c.	110—115	5 2 0	..
352,000	,,	,,	6⅛	57/6	Wimbledon 5 p.c. .	117—122	5 0 5	..
98,000	,,	,,	6⅜	63/9	Epsom 5 p.c. . . .	121—126	5 5 2	..
88,416	,,	June 26	3	3	3 p.c. Deb. Stk. . .	66—69	4 6 11	..

* Ex. Div. † Paid on Old 10 p.c. and 7 p.c. Standard Stocks.

Plymouth Gas Bill.—There is, it seems, some likelihood of this Bill being opposed by the Corporation on third reading—at all events, after a conference between the parties last Thursday, the matter is still under consideration.

Belfast Water Undertaking.—Mr. G. Bryan (the Irish Local Government Board Auditor), in his report on the accounts of the Belfast Water Commissioners, states that for the past financial year the income on revenue account was £127,363, and the expenditure (including £24,631 transferred to sinking fund) £115,051, showing a credit on the year's working of £8312, which, added to the balance of £30,930 at the beginning of the year, brought the balance to credit of this account up to £39,242. Of this the Commissioners have transferred £32,000 to the reserve fund, bringing the fund up to £72,000. The allocation to the sinking fund brought the total accumulation up to £356,586.

At the last meeting of the Westminster City Council, the Works Committee reported that they recently agreed to pay one-half the cost incurred by the Gas Light and Coke Company in obscuring lamps in connection with the reduction of public lighting. This arrangement was for six months only; and fresh arrangements being necessary, they had agreed to make payments at the same rates—3d. each for small, and 6d. each for large lamps—for all lamps obscured by the Gas Company on orders from the Council.

A strong smell of gas led to the discovery of Thomas M'Laren at a house in Bradford, lying fully dressed and dead on his bed. The gas had been left turned on, but not lit.

NEWSPAPERS FOR NEUTRAL COUNTRIES.

The Secretary of the War Office has issued the following order:

> The public are informed that newspapers and other printed publications will not be sent to Neutral European Countries unless posted direct from the office of publishers or newsagents who have obtained permission from the War Office for this purpose. Persons desiring to send newspapers, &c., to Neutral European Countries should, therefore, give their orders for execution to publishers or newsagents who have obtained such permission.

The Publisher of the "JOURNAL" has obtained the required permission of the War Office; and he will, on receipt of instructions, forward copies direct from the office to any neutral country.

WANTED, FOR SALE, CONTRACTS, &c., ADVERTISEMENTS IN THIS WEEK'S "JOURNAL."

Appointments, &c., Vacant.

MANAGER. Brampton Gas-Works.
MANAGER. Godstone Gas-Works.
SUPERINTENDENT. Aldershot Gas, Water, and District Lighting Company.
FOREMAN. Bombay Gas Company. Applications to London Office (Moorgate Station Chambers) by April 4.
COLLECTOR REPRESENTATIVE. Dorking Gas Company. Applications by April 3.
CLERKS (Male or Female). Aldershot Gas, Water, and District Lighting Company.

Appointments, &c., Vacant *(continued)*.

MAN FOR COOKER CAMPAIGN (Brazil). J. G. White and Co., Cloak Lane, E.C.

Appointments, &c., Wanted.

REPRESENTATIVE, &c. Z. L., 743, c/o Deacon's.
REPRESENTATIVE. T. Ousey, Manchester.

Plant, &c. (Second Hand), for Sale.

ENGINES AND EXHAUSTERS. Preston Gas Company.

TENDERS FOR

Coal.

DRONFIELD GAS COMPANY. Tenders by April 10.
LIVERPOOL GAS COMPANY. Tenders by April 7.
MACCLESFIELD GAS DEPARTMENT. Tenders by April 15.
NORTHWICH GAS COMPANY. Tenders by April 8.

Stoking Machinery.

HALIFAX CORPORATION. Tenders by April 3.

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No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

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